THE

# INGERSOLL-SERGEANT

DRILL COMPANY

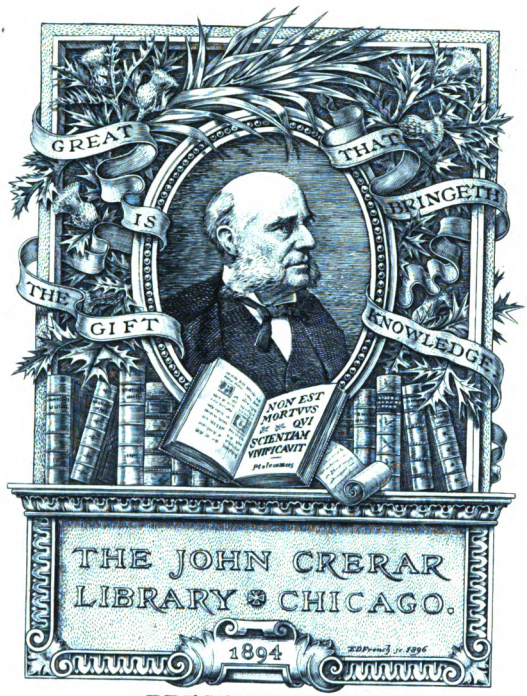
# ROCK DRILLS MINING AND QUARRYING MACHINERY

CATALOGUE NO 43

FIRST EDITION 1903

TELEGRAPH NAME "FOTHRE"

CHICAGO




PRESENTED BY

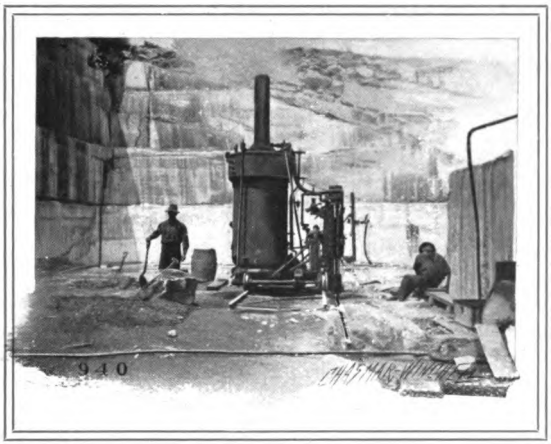
Ingersoll-Sergeant Drill Co.

# MINING, TUNNELING AND QUARRYING MACHINERY

Catalogue No. 45

# Rock Drills, Mining and Quarrying Machinery

Rock Drills, Stone Channeling Machines
Quarry Bars, Gadders, Coal Cutters



## The Ingersoll-Sergeant Drill Co.

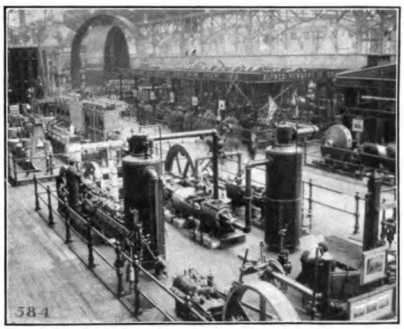
**Main Office**

26 Cortlandt Street, New York City

When referring to this Catalogue use the Telegraph Name FOTHRE

**First 1903 Edition**

## Principal Medals and Awards to The Ingersoll-Sergeant Drill Company



Glasgow Exposition

1871 American Institute, New York City. Only Medal for Rock Drills

1872 American Institute, New York City

1873 American Institute, New York City

1873 Mechanical Institute, Brooklyn, N. Y.

1874 Prince of Wales Medal, London

1875 Manchester Society of Scientific Industry

1875 Leeds Exhibition of Machinery

1875 Falmouth Royal Exhibition

1875 Mining Institute of Cornwall

1876 Centennial Exhibition, Philadelphia, U. S. A.

1878 Yorkshire Industrial Exposition

1879 Manchester Agricultural Show

1880 Sydney Exposition, Sydney, Australia

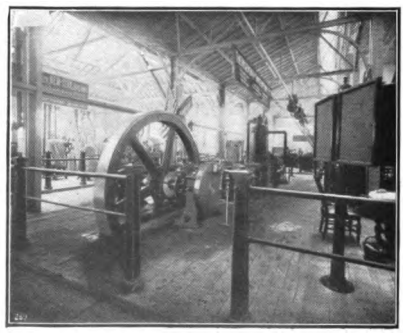
1889 Paris Exposition, France

1893 World's Fair, Chicago, Ill.

1900 International Exposition, Paris, France

Only Grand Prize given for Rock Drills, Coal Cutters and Channelers

1902 Glasgow Exposition



Paris Exposition

## Officers

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JOHN A. McCALL, } Vice-Presidents
W. L. SAUNDERS, }
GEORGE DOUBLEDAY, Treasurer
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PITTSBURGH, Park Building
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JOHANNESBURG, South Africa, P. O. Box 1809
VALPARAISO, Chili, Care W. R. Grace & Co.

# We Claim That

**The INGERSOLL-SERGEANT Drill Company is**

The oldest and
The largest concern in this line

**Its Works are**

The most complete and
The most modern of any in the field

**Its Material**

The best and
The strongest to be obtained

**Its Product**

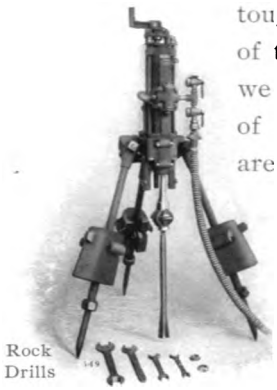
The most advanced and
The most efficient in the world

**Its Guarantee**

The broadest and
The safest of any reputable company

## Rock Drills

Few materials are less uniform than the various rocks and ores, and extraordinary variations are found in hardness, toughness or in the solid or broken character of the material to be worked. Because of this we make four different types and several sizes of rock drills. The latest improved models are known by the following names:



Rock Drills

**The Sergeant "Auxiliary Valve" Drill**

Having a spool valve controlled by small auxiliary valve, for air or dry steam; more especially for hard service and fast work. Described on page 36.

**The "Arc Valve" Tappet Drill**

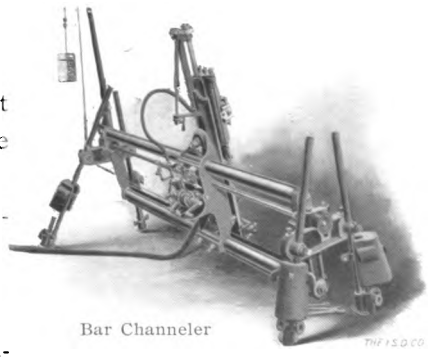
Having a slide valve moved by the piston, for wet or dry steam, or for air; usually selected for the softer rocks. Described on page 42.

**The "New Ingersoll" Drill**

Having an independent spool valve, an improvement on the old "Eclipse." An "all-around" good drill for steam or air. Described on page 46.

**The "Eclipse" Drill**

Having an independent spool valve, the earliest type of successful drill; used with both air and steam. Illustrated on page 50.

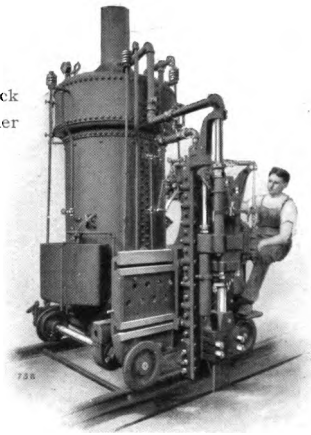


Bar Channeler

## The Bar Channeler

A stone channeling machine of service in developing small and medium quarries, or for cross cuts and getting out dimension stone in larger quarries.

This machine cuts a narrow slot in the rock up to 8 feet in depth, freeing the blocks from the solid ledge, thus effecting a saving and a reduction in the waste of material.

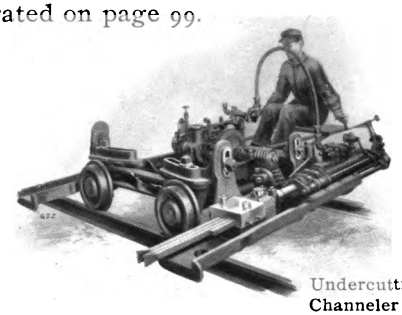


Track Channeler

## The Track Channeler

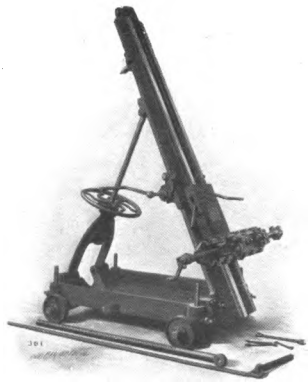
In large or permanent quarries, the bar channeler is generally used for key blocks, sumps, short or cross cuts. The long, heavy cuts are usually made by these track channelers, which automatically travel along a track and cut to a depth of from 8 to 16 feet, either vertically or at an angle, as may be required by the dip of the quarry. Illustrated on page 99.

## Undercutting Channeler



Undercutting Channeler

This apparatus travels automatically along a track and carries one or two powerful drills, modified for light channeling service, which are placed horizontally at its ends. The cutting is done close to the floor in a horizontal or slightly inclined plane. A cut up to 8 feet deep is thus made to any length, and the rock loosened by vertical channeling or splitting from the top. Described on page 101.



Gadder

## The Gadder

A rock drill mounted on an adjustable frame fitted with wheels, and used principally in marble quarries, although useful in other work. It drills a series of holes in a true line for "plug" work, and serves as a substitute for the undercutting channeler for "lofting" or

breaking the stone away from the floor of the quarry, when this can be done by splitting. With this apparatus holes can be drilled on the line of the "riving bed" or the "shearing plane," or at any angle, and the material removed in blocks or layers. Described on page 92.

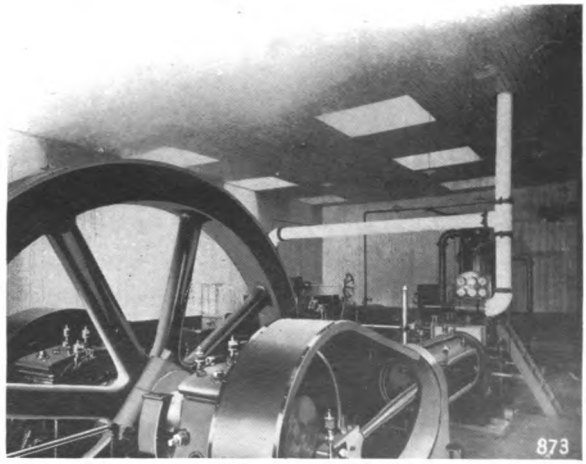
Coal Cutter

## Coal Cutter

A substitute for the old system of a man with a hand pick. It is capable of undercutting from 5 to 15 times as much as one man. A compact, durable and efficient labor saver meeting with remarkable success. This is described in our special Coal Cutter Catalogue No. 51. Mentioned on page 142.

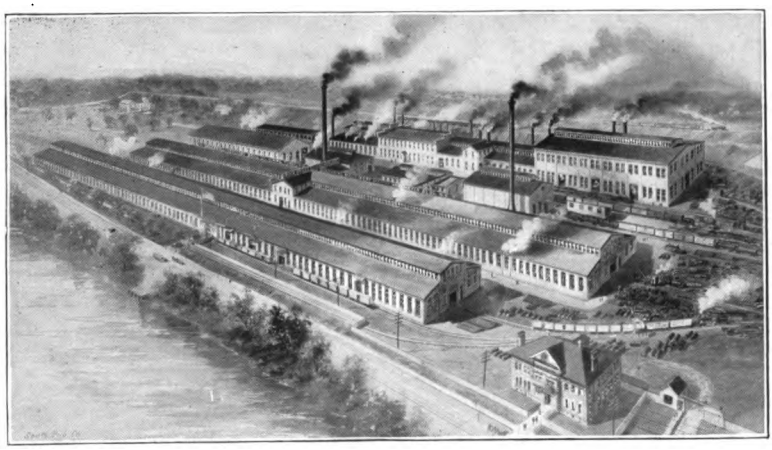
## Air Compressors

We merely mention at this time the fact that we are the largest manufacturers of compressors for all duties and capacities. These can be used for operating the apparatus above outlined, and some of them are especially satisfactory for mining and quarrying apparatus, but a discussion of these cannot be given in this catalogue. For full data regarding air compressors, we refer you to our special Compressor Catalogue, corresponding in character with this book, which will be mailed you upon request. Mentioned on page 149.




Air Compressor

For index to Telegraph Names, see pages 159 to 161.
For General Index, see pages 162 to 166.



Easton Works, the Ingersoll-Sergeant Drill Co.

# The Ingersoll-Sergeant Drill Company

## Easton Works

Our present works are the largest and most complete of any engaged in the manufacture of compressors, rock drills and quarrying machinery. Situated about 80 miles west of New York and north of Philadelphia, at Easton, Pa., on the main line of the Lehigh and Central New Jersey railways, on the Lehigh River, in the heart of the coal and iron mining region of Pennsylvania, it has all natural advantages of location. These have been supplemented by the erection of a complete and modern manufacturing establishment in which the buildings, exposed storage and railway sidings, cover about 23 acres.

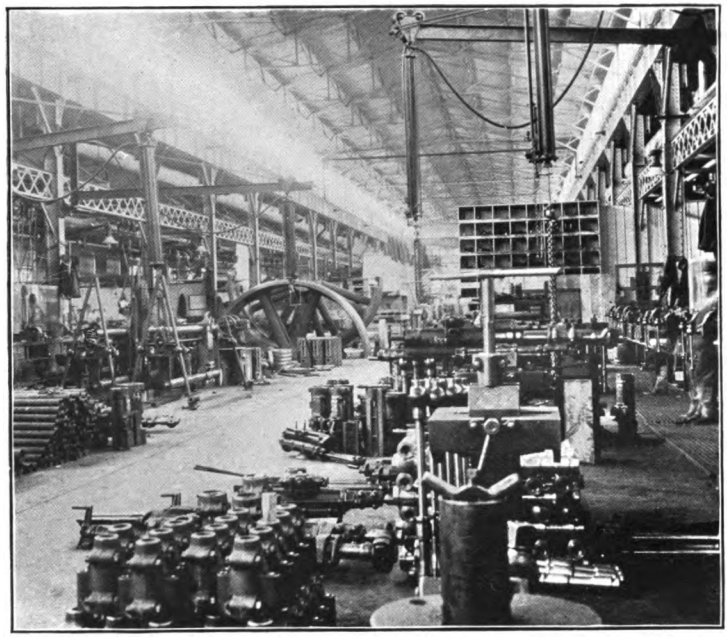
## Phillipsburg Works

The rapid growth of our business has made it necessary to largely increase our output, and further extension at Easton being impossible, we have recently acquired 190 acres at Phillipsburg, N. J., in the vicinity of our present works and have begun the erection of another model plant which, when completed, will again be the most extensive works of this kind in the world.

It is expected that the new foundry, a building 500 feet long and 160 feet wide, with its necessary pattern shop,

pattern storage and casting cleaning buildings will be ready in the spring of 1903. This foundry will have a daily output of double our present capacity and will be the first of a number of large factory buildings which will be erected as rapidly as possible.

When the new plant is completed the Easton works will be given up solely to the smaller sizes of compressors; larger compressors and other machinery which we manufacture being produced in the Phillipsburg works. The change will be gradual, so that no interruption will occur.

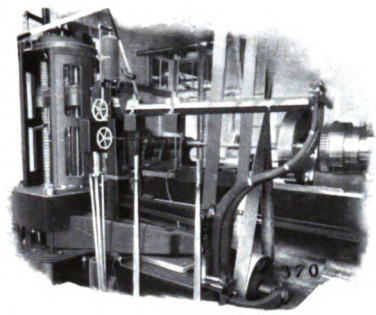


Corner of Drill Assembling Department

In the Easton works at present we have over 1,750 men regularly employed in the foundry, forging, machine, erecting, testing and other departments. The annual capacity of these works is over 68,000 horse power of compressors, about 3,500 rock drills and 1,000 coal cutters, and in addition a considerable number of channeling and other quarrying machines, and special apparatus for mining.

The works are specially well arranged and systematized and are equipped with every means to facilitate the handling

of heavy pieces through each department, and from one tool to another, and hand labor of all sorts is reduced to a minimum. Raw materials enter the stock buildings at one side direct from the railway cars, and pass consecutively through the foundry or blacksmith shop into the machine shop, the erecting floor, then to the testing floor, and finally to the painting, packing and shipping department, where it is prepared for its journey, be it either a few miles or to the most remote parts of the world.



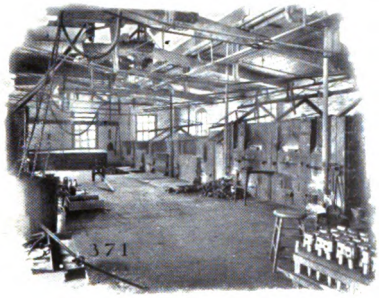
Material Testing Room

## Improved Manufacturing Machinery

Our works are equipped with the most perfect machinery made by the best tool builders, and much of it has been designed to meet the special conditions arising in the manufacture of our apparatus. The Ingersoll-Sergeant policy is to abandon any tools, patterns or methods as soon as an improvement can be found which will tend to better the endurance or the operation of the machine on which it is used.

## Raw Materials

All raw materials are purchased under test guarantees, and in our own testing department cast iron, steel, malleable iron, and all materials used in the construction of our apparatus are examined and verified by our high standards, samples being taken from each lot purchased, and other samples being taken from each day's cast in the foundry to maintain the highest grade of output.



Oil Treatment Heating Ovens

Our standing guarantee is to make good by repair or replacement any defective material or workmanship found in our apparatus. We can afford to do this because our careful system of inspection and material testing reduces occasion for complaints to a remote possibility.

The character of work to be done by portable machinery absolutely fixes the minimum limit of strength and rigidity for a given piece of apparatus, and when improvements in design approach this limit, reduction in the size of parts or the weight of the material used can only be made by the use of better material. We do not claim that this apparatus is unbreakable, and that it will never wear out. On the other hand, we distinctly state that we have used our experience to perfect this machinery to a point when with fair treatment and freedom from abuse all users may expect good results continuously with a minimum of delays in operation and minimum expense for repairs and that we are improving still as skillful methods and better materials develop.

## Experience of Thirty Years

We have had a wider experience in percussive machinery than any one else through the development of the rock drill, channeling machine and coal cutter, during a period covering over thirty years. We have built and sold over 45,000 rock drills and our capacity to-day is about 300 per month, and the capacity for air compressors is greater than that of any other maker in the business.

We have had more experience in the manufacture and use of rock drills and quarrying machinery and air compressors than any other concern in the world. Our present designs are the result of this experience, and they are original and covered by patents. The foregoing reasons are the basis on which we rest the claim that Ingersoll-Sergeant apparatus is the best obtainable. We aim to make the name Ingersoll-Sergeant synonymous with perfection.

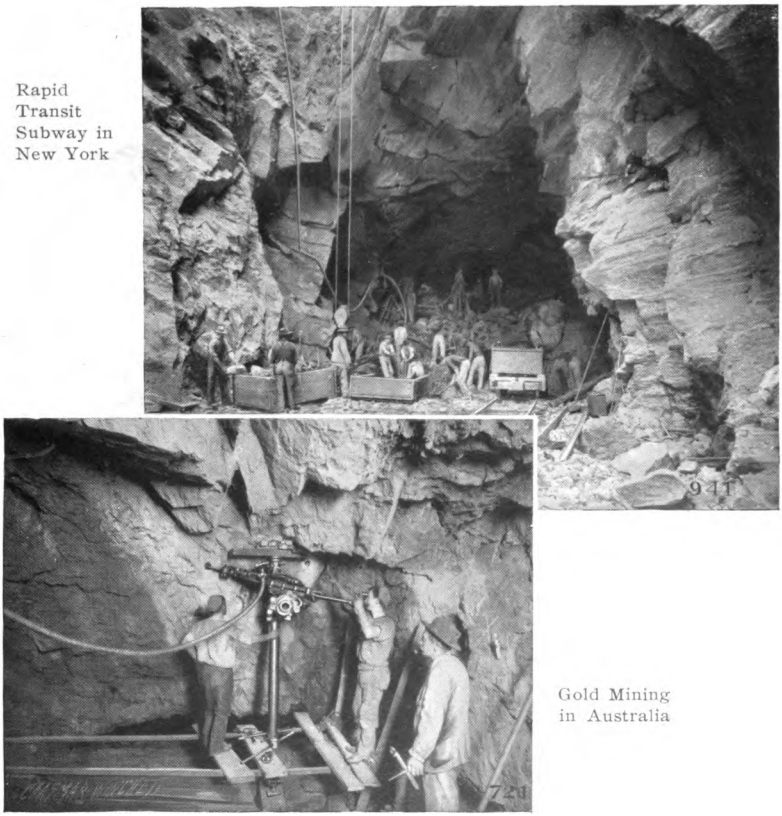
## The Customer's Welfare

We have made it a rule to look carefully after the welfare of our customers and those buying Ingersoll-Sergeant machinery buy with it a right to consideration and conscientious care not often found in this business. It is as much to our interests as to our customer's that a plant be a success in all details, the most perfect of all advertisements being the satisfied customer who tells his neighbor how carefully he was looked after in all emergencies, how perfectly satisfactory everything was in its going together and operation, and

advises him to go and do likewise. Our interest in the machinery continues as long as there is anything left of it to operate.

## Details of Standard Machinery

The following pages describe in detail the standard Ingersoll-Sergeant apparatus for the excavation of rock and ore. We suggest that you read this through carefully, as the probabilities are that some of the machinery would effect a considerable saving in your case. Should you desire further information, or an estimate for which we make no charge, please write our nearest branch office, or direct to our main office, 26 Cortlandt Street, New York City.



Rapid Transit Subway in New York

Gold Mining in Australia

Tunneling with Ingersoll-Sergeant Rock Drills


The Hudson River Tunnel, New York, Charles M. Jacobs, Chief Engineer. Showing use of Compressed Air Drills Drilling Rock Under Air Pressure

# Suggestions for Intending Purchasers

## General

We call particular attention to the code or telegraph names which we have inserted in this catalogue, for greater accuracy and convenience, and urge that they be used.

The construction of these words in most cases suggests the article wanted and thus avoids errors in your selecting or our understanding the code word.

To illustrate this: The code names of all "New Ingersoll" drills begin with "N" and terminate with the letter indicating the size, thus, "*Nabob*," meaning "New Ingersoll," size "B" drill, complete as usually sent out. "s" added, as "*Nabobs*," means the drill alone, that is, unmounted and without tripod or weights.

Again, "*Sergea*" means a "Sergeant" tripod with Sergeant saddle, "A" size, while "*Seringea*" means a "Sergeant" tripod with Ingersoll saddle, size "A."

Too much care cannot be observed in making out orders and every identification mark asked for should be given.

In asking for quotations please answer all questions asked under the heading applying to your case, as given on pages 19, 20, 22 and 23.

## Duplicate or Repair Parts

In ordering duplicate or repair parts, examine the duplicate part sheet referring to the particular apparatus you have. Be sure you have the right sheet, then give the name and number of the part and the name, number and symbol of the complete machine. In the case of drills this number is always stamped on a boss or numbering space on the front of the cylinder at the top near the back head and in a prominent place, and a little rubbing with a file in the case of old or dirty machines will bring it to light. While we have the most careful records of every piece of machinery we have ever manufactured, still your drill is one out of probably 40,000, and without its number we cannot guarantee to send you the right parts. In fact, if correct information is not furnished, delay results from our being obliged to write you for further data.

Always give the markings found in the places indicated. This cut shows all markings necessary.

Give with the order full and accurate marking and shipping directions, *including county*, as it will enable us to make more prompt delivery.

Anticipate your wants a little and order ahead, as it will prevent annoyance should shipment be delayed by the transportation companies. Better write too much than not enough.

A. Shop or serial number.
B. Drill symbol.
C. Style of shell, Ingersoll or Sergeant. (This shows Sergeant.)
D. Marking or style of front head. (Air or steam.)

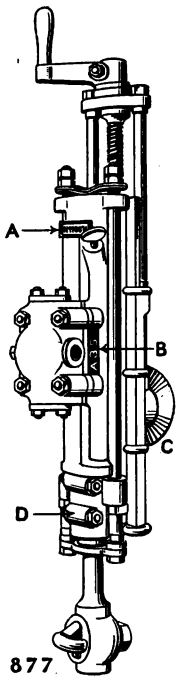



Diagram indicating information necessary to fill orders for duplicate parts

# Rock Drills: Information Required for Correct Estimates

AS Ingersoll-Sergeant Drills are mounted in several different ways, and are made in so many sizes, we should be informed as to the details of your work when you ask us for quotations. By faithfully answering the following questions we will be able to give proper advice as to machines best suited for the work you may have in hand.

When other information is not obtainable we should at least know the character of rock and depth of holes to be drilled.

## For Quarrying (See also page 22)

1. Location, whether on surface or underground.
2. Nature of rock, whether sandstone, slate, limestone, granite, marble, etc., and whether hard, soft or medium.
3. Is dimension or broken stone to be quarried?
4. If shelly, state whether tight or loose.
5. What is the average depth of holes to be drilled? (It is important to know this.)
6. Extreme depth of holes; are there many or few of these?
7. Average diameter of holes at bottom, or if undecided, state whether dynamite or black powder will be used.
8. What is the greatest distance steam will have to be carried?
9. A rough sketch of quarry is very useful and also a small sample of stone or rock. If latter is sent it should be properly labeled with name and address of sender, and prepaid. A 3-inch to 5-inch cube is a good size.

## Railway Cut or Excavation

10. Give dimensions of cut, and also such answers to the above questions as may apply to the case.

## For Sewer or Trenching Work

11. Answer questions 2, 6, 7, 8, 9, 10, 11, as above.
12. Give width and depth of trench, stating depth of rock to be removed.

## If Compressed Air is to be Used

13. What is altitude above sea level?
14. Where is compressing plant to be located?
15. How near to fuel and water, and kind and cost of fuel?
16. How far is plant from work to be done?
17. If other machinery is to be run by air, give cylinder dimensions, speed, running time, pressure necessary, location, etc.

18. Is compressor to be run by steam, water power or electricity?
19. What is steam pressure?
20. Is compressor to run condensing or non-condensing?
21. What horse power of boiler have you available?

## For Metal Mining

22. Full information as to nature of ore.
23. General system of mining.
24. Dimensions of shaft, drift and winzes.
25. Is compressed air equipment wanted? If so, give answers to questions in preceding paragraph referring to compressed air.

## For Tunneling

26. What is nature of material to be passed through?
27. Dimensions of tunnel.
28. Its proposed length.
29. Are heading and bench to be driven together or will heading be driven alone and bench after heading is finished?
30. Is tunnel to be driven from one end or both?
31. Are shafts to be sunk? How many? Give their depth, dimensions and what material to be penetrated.
32. It is sometimes preferable to furnish compressed air from a central station by pipes leading from end to end. Such stations should be located where coal and water are accessible. In such cases give answers to questions in paragraph referring to compressed air.

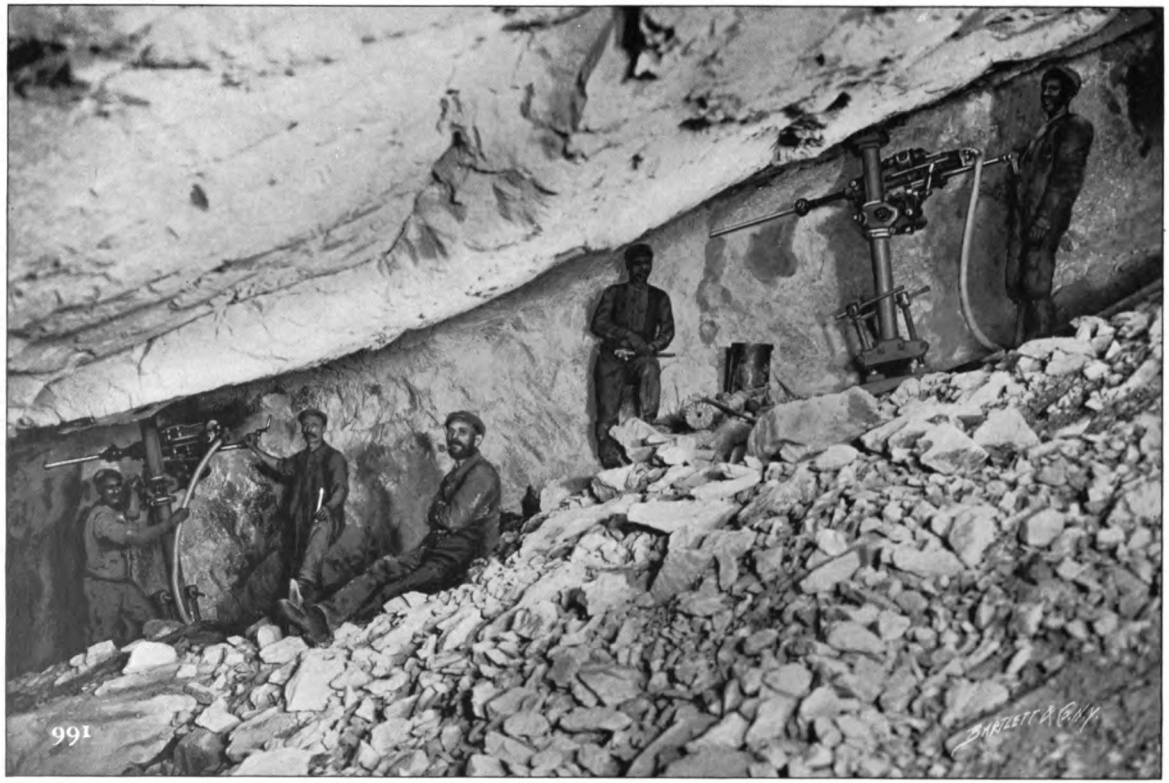
## For Shaft Work

33. Dimensions.
34. Depth proposed, nature of rock or ore. If air compressor is to be used, give information requested above.

## For Submarine Drill Work

35. Greatest depth of water from surface to rock for which allowance must be made.
36. Depth of rock to be blasted, or depth of holes to be drilled; if possible, state maximum and minimum depths.
37. Rise and fall of tide, if any.
38. Velocity of current, if any.
39. Is the drilling to be done from a scow, pontoon, platform, or what?
40. Is rock covered with mud, clay or sand, if so, how deep?

In ordering Duplicate Parts give shop *number of drill*, which will be found stamped on the front of the drill cylinder near the back head, and number and name of part given on proper Duplicate Part Sheet. (See also page 18.)




Gold Mining Scene, South Africa, showing Drills on Columns Following Vein

# Channelers, Gadders, Etc.—Information Required

AS the work done by these important labor savers is largely influenced by the character of the material, the greatest care is advised in explaining the requirements, and when the rock is not uniform samples of all the different strata should be submitted—the worst as well as the average. Flint, mud seams, whether vertical or inclined, hard streaks, clay or other pockets, all these are vital, and safe recommendations can only be made with full and unbiased recognition of the faults of each quarry. The roughness of the floor or beds and its general degree of inclination when not level should be clearly brought out, stating whether the work is with, against or across the dips; when water is encountered to the point of channeling under water we should know it.

The following questions cannot possibly cover all the difficulties which are occasionally met, but are intended to develop the facts, and it is to the purchasers' particular interest that we are not misled by a partial statement; on the contrary, the more complete and full our knowledge, the better for the buyers. Our experience is more broad than that of engineers and experts in that it is built on thousands of cases all over the country, wherever such machinery is used.

In the case of important and large equipment we recommend that one of our practical men examine the ground. In case of sales we can usually supply experienced operators of channeling machines for an introductory period at the usual charge.

## Information Required for Correct Estimate

1. Location—relative to railways, waterways or roads.
2. Kind and character of rock, whether marble, sandstone, etc., and hard or soft.
3. Open or underground quarry.
4. Dip or angle of cleavage plane.
5. Is rock homogenous or has it seams and faults?
6. Is dimension or broken stone to be quarried?
7. Average size of blocks.
8. Annual or monthly output in tons.

9. Is property on a bluff or is quarry to be sunken?

10. Number of men employed at present.

11. Do you want compressed air or steam apparatus?

12. What will be the greatest distance to which the air or steam will be piped.

13. Samples of rock should be sent prepaid, carefully labeled. A 3 in. to 5 in. cube is a good size.

14. Have you derricks or hoisting apparatus?

15. Send photos or sketches whenever possible—better say a great deal than too little.

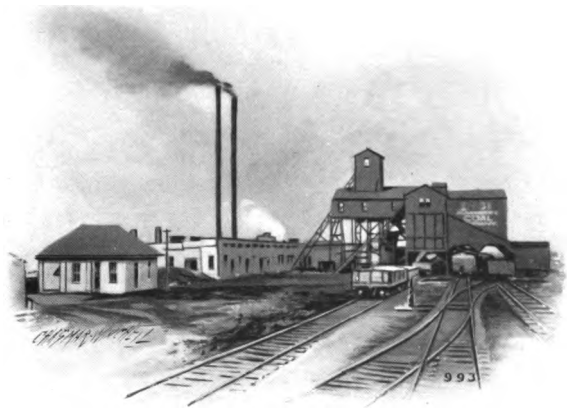
16. Has the quarry free horizontal beds? If so, state their successive thicknesses.

17. The depth of channel to be cut, average and occasional greatest depth.

18. Does pressure exist? Give full information.

19. Are there hard knots, balls, nigger heads, flint streaks or other special features? Send samples.

20. Are there mud seams or other seams? If so, state distance apart, thickness, whether vertical, horizontal or at an angle, etc.



# Economy of Machine Rock Drilling

IT seems almost unnecessary at this date to argue or prove that hand labor in the case of rock excavation is an extravagant waste, quite as much so as in the case of general manufacturing. But the fact that frequently hand work is attempted is sufficient evidence that the remarkable economy of machine work over hand labor is not well understood by all, and warrants a few remarks on the subject.


The system or machine that accomplishes a given result quickest, best and at the least cost is the one to be selected, and an understanding of this fact is the secret of the wonderful mechanical advancement of the United States. The appreciation of the wisdom of heavy investments in improved labor-saving machinery, which permit the output of a factory to be rapidly increased, with reduced cost to meet any sudden and large demand, is also an important factor in our wonderful growth.

It is equally true that in any given case the fewer men employed and the shorter the time over which the work extends, the less likelihood of accident and delays resulting from climatic, political or labor disturbances.

In the case of quarries, many of which are worked only a portion of the year, any means that will enable the output to be doubled during this working period will double the earnings, provided the operating expense is not increased. Improved machinery will do this. If proof is necessary, dozens of examples of this can be produced. In any case the actual saving to be

effected depends upon so many local items that it is hard to give definite figures without a full understanding of the present conditions, but the question is often asked, "How much more can we do if we use your machinery?" On our part we cannot, without full details of your conditions, do more than give a sort of average arrived at by an examination of a large number of cases.

As the largest and oldest manufacturer of rock drills and quarrying machinery and with a greater output than possibly any two other concerns, we have naturally accumulated a mass of information on this subject. Space forbids any extended discussion, but the following extracts from letters are typical, and indicate in a general way what has been done and what may be expected under like conditions.

## Work Done

Usual drilling experience is from 60 to 150 lineal feet of hole drilled per day of 10 hours in ordinary stone, including shifting, setting up, cleaning holes and all work from start to finish.

In tests and special cases these figures have been largely exceeded, sometimes as much as 400 lineal feet being made; other records of 24 inches per minute are not uncommon, all, of course, for down holes in favorable rock, but 70 feet per day of 10 hours in granite, including moving and setting up, affords a fair working basis. Better results being obtained in any case when air is used instead of steam.

## Cost of Drilling

The cost of drilling in this way may be stated to vary from 2½ to 13 cents per lineal foot, according to local conditions, but from 4 to 5 cents per foot of hole drilled may be taken as a working figure for general calculations, and this includes all expenses. Compared with hand methods, the cost of which runs from 25 to 70 cents per foot, with an average of 40 to 65 cents per foot of hole in hard rock, this shows that a given amount of drilling can be accomplished for from one-sixth to one-twelfth the cost of doing it by hand.

## Extracts from Letters

The following are extracts from a few of the many letters we have received relative to the work done by Ingersoll-Sergeant Rock Drills and the cost of such work.

"Can do more than 100 feet per day of 10 hours."

"One-fourth to one-fifth the time hand labor used to take."

"Far beyond what could be done with hand."

"One drill drilled 14 2½ inch holes from 10 to 14 feet deep in one day."

"Drills 60 per cent. more than hand methods."

"Eight cents per ton for drilling and blasting. 13½ tons of rock loosened per pound of explosive."

"Average saving from $165 to $190 per 1000 tons of rock."

"10 to 12 feet per hour, 80 to 90 feet per day; 37½ cents per foot of hole by hand; 4½ cents per foot of hole with steam."

"100 to 150 feet per day."

"12 feet of 2 inch hole in 39 minutes; hard limestone."

"130 feet in 10 hours."

"2 feet in 4 minutes, average."

"43 holes 30 inches deep in 10 hours."

"One man with drill can do more work than 20 with hand."

"92 feet in 9 hours; average, 75 to 85 feet. Does the work of from 12 to 14 men."

"About 100 feet per day of 10 hours."

"20 feet 3½ inch hole in 1 hour and 20 minutes."

"Work of 10 or 12 hand drillers. Will make a foot per minute."

"70 feet of hole in 5 hours; 15 moves. Always figure on 100 feet in 10 hours."

"Less than 50 per cent. of the cost of hand labor."

"100 to 150 feet per day of 10 hours. Cost of three drills per day about $3.50 each. Hand cost $4 per gang and only drilled 25 to 40 feet in same time."

"100 feet in 10 hours; average, about 80 feet."

"Saves from 12 to 15 men per day."

"Hand labor, $2.15 per cubic yard. 200 feet of 1 inch hole by drills cost $1.07 per cubic yard average."

"308 feet in 10 hours; 527 holes 7 inches deep. With hand work, 23 holes per man per day."

"4½ cents per foot by drill; 61 cents by hand."

"100 feet in 3½ hours."

"1 foot per minute on an average in sandstone."

"6⅞ cents per foot by hand; 13½ cents by steam."

"Average 175 feet per day in medium sandstone with air."

"Cost about one-seventh of hand labor."

"Will do the work of 20 men with hand drills."

"Average 150 feet each 10 hours, in limestone, with air, and have run 200 feet."

"200 feet per day cost 3½ cents per foot."

"Does the work formerly done by 15 men by hand."

"Average 90 to 110 feet in limestone, putting down 20 feet holes."

*Durability and Repairs*

"Five years of steady work and not yet cost $10 for repairs."

"Self-preservation has compelled us to exchange to your make because of repairs."

"Purchased ten years ago, running up to date very satisfactorily."

"Average not over $15 per drill per season for repairs."

"The actual cost of this drill per year has been but $11. In constant use for seven years."

"It does not cost me on an average over $2 a year to keep in good order, working in granite."

"Our service is hard, but repairs are under $25 per year."

"Constantly at work for twelve years, the repairs have been light."

"Our drill started in 1876—running yet."

"The repairs have not exceeded $2 on one machine in eight years."

"In use for seven months and has cost 12 cents for repairs."

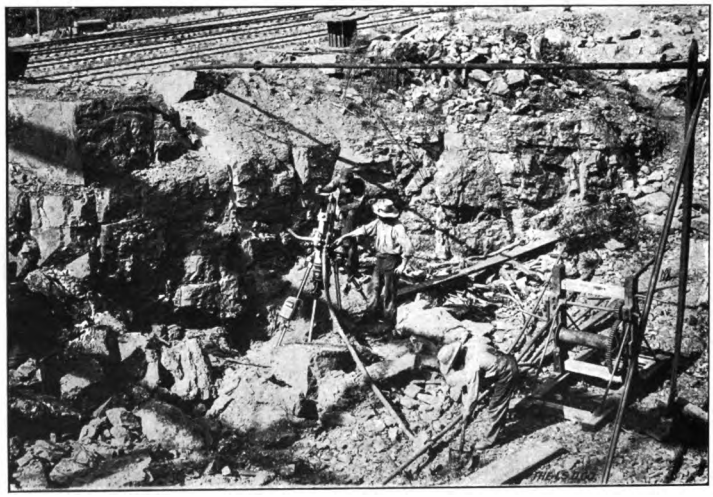
"Outwears two drills of ——— make."

Examples of this sort can be multiplied. They all, however, demonstrate the fact that the frequency in repair on Ingersoll-Sergeant Drills, even under most unfavorable conditions, is very small, and with each year's improvements becomes less.

# To Select a Drill

TO make the best selection of any article, the principles involved in its use must be understood. Now the principle of successful rock drilling is to get a hole into the rock, of the right size, as rapidly as possible with the least hand labor, the amount of mechanical energy with practical men taking a secondary place.

There are two ways of drilling; one, the auger drill, which bores the rock, the other the percussive drill, working by direct impact, that is, by striking repeatedly in the same spot, and by simply bruising or chipping away the rock. Long and expensive experience has shown finally that a reciprocating punching or percussive drill is the best suited



"Eclipse" Drill on Railway Cut Work

for drilling rock. Admitting this for the moment, let us consider what are the fundamental points necessary in the best percussive type.

Power drilling is simply an advance over hand drilling, in which a steel bar with some form of point or chisel edge is placed against the rock, and repeatedly struck with a hammer. The rapidity with which this drill would cut in a given case would depend upon the number and force of the blows struck upon the head of the drill. Therefore, a machine to act as a

substitute, an improvement on the hand drilling method, must be capable of striking powerful blows at a very rapid rate.

With the hand method two men are required, usually more; one man to hold, guide and turn the drill, and the others with hammers to strike the blows. With the adoption of a machine for this purpose, it is possible to clamp the steel to the machine, and thus at once do away with one man. As the machine is striking a blow far more rapidly than can be done by hand, we thus do away with the other man, reducing the number of operators to one man and perhaps his helper.

## Essential Features of a Good Rock Drill

Admitting that such a device is an improvement over hand methods, what features are essential to a permanent success? First and foremost, the mechanical principle and construction must be perfect; there must be no hitches about it; it must always be ready to operate and under absolute control of the operator, so that a hard or a light blow, either long or short, can be struck at his will. It must be light, so as to be portable, easily erected and dismantled; compact, so that it can be used in restricted and out of the way places; it must be made of exceptionally good materials, to insure durability of all its parts; it must not be complicated and it must be made up of pieces so formed that they can be quickly removed, all being interchangeable; it must be so simple that its successful operation is readily mastered by the men at hand, and it must not have any parts which grit, exposure, or rough usage can seriously damage.

## Simplicity of Apparatus

A marked peculiarity of all machinery built by the Ingersoll-Sergeant Company is its extreme simplicity and absence of complication, and the ease with which any part can be gotten at with a minimum disturbance of other parts. A common remark is, "It is trained down like a thoroughbred." Such machinery can be put into the hands of an ordinarily skillful man with the greatest success, and is not, like inferior machinery, soon at a disadvantage with slight wear.

An example of this is the piston, which including rod, head and chuck, is in one piece. If the piston head were fastened to the rod, the rapid blows and the sudden and solid resistance met would tend to jar the parts loose. Neither is it advisable, although sometimes done, to place a separate chuck on the end of the piston rod, since our improved front head design has removed the reason for that construction, and since the piston must stand the shock of from 400 to 600 blows per minute, ranging from 300 to 1500 pounds for each blow, which in the course of ten hours means 240,000 to 360,000 blows, and runs into millions of blows monthly.

To avoid leaks and insure smooth running, the piston should be a perfect plug fit in the cylinder; our construction is exact to the thousandth part of an inch. The piston is forged from a specially made steel of the highest grade, giving a hard, slow wearing head with a tough rod which does not crystallize; after turning and hardening it is ground on centers to absolute truth, and being very hard the wear is confined to the cylinder, as costing less to replace, and maintaining standard sized parts, enabling the owner to practically renew his machine at moderate cost. The cylinder is so close-grained and even as to polish like glass, of material 25 per cent. better than U. S. Government requirements and is in like manner reamed to exact gauge.

This example serves to indicate why our rock drill is an expensive machine to manufacture, and it also bears out our claim that while these machines are built for the roughest handling, they are constructed as accurately as the best bicycle.

## Material

Again like this bicycle, our rock drill is necessarily built with a small factor of safety or margin of strength. For this reason, to meet the requirements of lightness with durability, it is absolutely necessary that only the best material be used in construction and that the most thorough inspection and tests be employed.

It is our standard practice that principal parts in Rock Drills, Channelers, Compressors, Valves, etc., subject to shocks and unusual strains, are made of such special grades of steels as have been proven by experience to be most serviceable and best adapted for its particular use, and such

parts are further toughened and strengthened by a process of annealing and oil treatment also adopted by the United States Government for ordnance forgings. This system, not used by others because of its cost, is one reason for the marked and steady reduction in cost of maintenance of our machinery and its increased life. The testing machine shows a doubling of the elastic limit, samples running up to 135,000 pounds per square inch section before breaking.

## Interchangeability

Another feature which plays a very important part in the success of our drills is the fact that mining and quarrying are usually conducted in districts remote from quick communication with the outside world, often in the heart of mountainous districts miles away from factories and machine shops, frequently in sections where for weeks or months at a time access to the outside world is closed, and it is, therefore, necessary that repairs can be made by inexperienced men, practically with the hands alone.

For this reason Ingersoll-Sergeant Drills are made on the interchangeable plan, and at our factory we employ a most complete system of jigs, templates, dies and gauges, so that parts are duplicated by the thousand with such accuracy that we are enabled to send from our factory to South America, Africa or India a duplicate part on cable orders which will fit as though it was the original piece. Our system of dies, templates and jigs and complete measurement is such that we reproduce parts in ton lots whose dimensions do not vary more than a thousandth of an inch.

This system of manufacture is one whereby it is to the interest of our workmen to report anything not up to standard rather than to cover it up. Because of this feature, mine operators can order 10 drills or 700 drills, and the parts of any one will fit in the proper place of any other. This interchangeability is absolutely impossible where apparatus is manufactured in small quantities, and it is, therefore, to your advantage to purchase Ingersoll-Sergeant Drills, even if some other maker should have a drill which individually would work as well or cost less.

# General Features Common to

## The "Sergeant Auxiliary Valve"
## The Sergeant "Arc Valve" Tappet Drills
## The "New Ingersoll"

### Materials

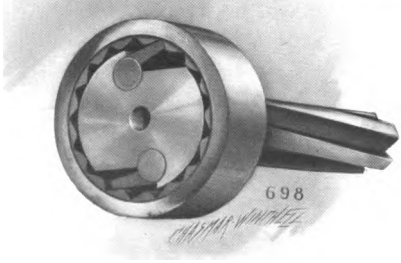
In practically all details save the valve motions, these three models are alike, all having the "Sergeant" improvements. The workmanship and material are the same, we making only one grade—the best. We long ago abandoned common cast iron as unequal to the severe demands of drilling, and at present only steel castings, tool steel, malleable iron, drop forgings and special metals are used where best suited.

### Valve Motions

The valve motions differ to best adapt the drills to various kinds of work, providing for hard, medium and soft materials, solid and broken grounds, wet and dry steam or compressed air. The fastest work under given conditions is reached when just the right model and size is used, but each of these drills is a good "all around" machine.

### Rotation Device

The rotation device is the most perfect yet designed, being simple, positive and durable in its parts, easily got at and so arranged that the flat steel cushion head springs give an adjustable friction clutch effect, allowing the rifle bar to slip backward before breaking any of the parts or twisting the bar, should the bit strike a glancing blow. This enables the machine to work itself free in seamy or caving ground, and is an essential feature for a perfect drill. The ratchet is drop forged, ground and carefully hardened. The small pawls are tool steel hardened in oil, as is also the rifle bar which runs in a removable bronze nut screwed in the end of the piston, thus easily replaced when worn.



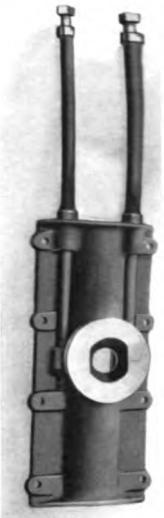

Patent Rotation

## Feed Nut and Screw

Feed nut and screw are spring steel, accurately made and hardened tough. The crank is adjustable for wear on the steel crosshead and is made of malleable iron to stand rough usage.

The malleable shell gives an extra large wearing surface for the guides, and the caps are arranged to take up wear.

The largest experience in drill manufacture has shown this to be important, especially in hard, bad ground. Drills for which greater simplicity of construction is claimed will be found lacking in adjustments for wear, requiring a rejection of the entire shell where a few strokes with a file will put our shell in condition equal to its original tightness.

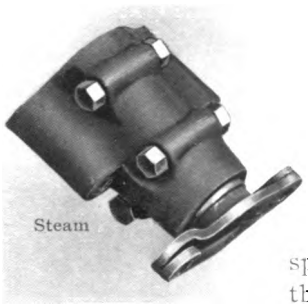


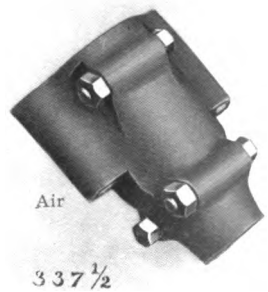
336 D
Shell and Standards

The shell is attached to the mounting with the Sergeant reversed cone, so that the drill can free itself in a crooked hole, or swing aside and come back in perfect alignment. A feature appreciated by experienced miners.

## Pistons

The pistons are heavier with longer heads, giving great striking effect and increased guiding and bearing surface to reduce piston and cylinder wear. Special high carbon "drill piston steel" is used for rods, and these are forged, straightened hot, machined and toughened to prevent breakage and crystallization, by means of a special oil process. A special grinding machine leaves these the exact size, polished and true as a die. The chuck has a hardened elastic key and the tempered steel bushing can be renewed when worn.




"15" Style Front Head

## Front Head

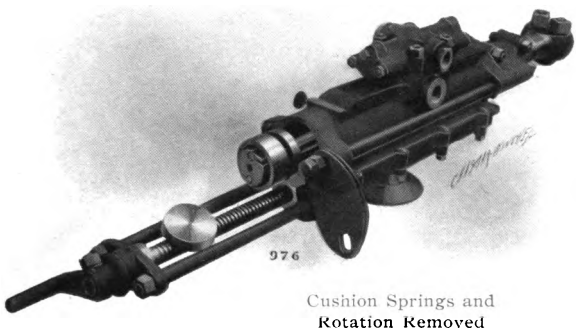
The new Front Heads, "15" style, are of special metal with the best gland ever devised for this troublesome place. They are made for steam or air and

split so that they can be renewed when worn. With the steam head the gland bolt screws in an extension on the through bolt, thus referring all strains directly to the cushion springs and obviating lugs and projections on the head. This gland cannot work loose and drop off, and on account of its rigidity the drill piston is well supported when fully extended, and binding and uneven wear are avoided.

When air is used a special front head of the same type is furnished, which has a cup leather packing ring and dispenses with the stuffing box altogether. *Buyers should always state "steam head" or "air head" on orders.*

## Cushion Springs

The Sergeant Patent Flat Cushion Spring is now used on all but the "Eclipse" drills. This head cushioning device is the most simple, safest and most durable form yet brought forward and is an infinite improvement over rubber cushions or coil springs. The flat spring rarely breaks, oil cannot affect it and it does not deteriorate with exposure. It protects both heads, not simply the lower head. Any blacksmith can make a new set, which is impossible with other forms. In addition, it permits the drill to be taken apart more easily and quickly than other devices, as removal of nuts from one through bolt exposes the entire rotation mechanism. This spring is, all in all, one of the most important improvements made since the introduction of rock drills.



Cushion Springs and Rotation Removed

## Cylinders and Valve Chest

Cylinders and valve chests are of the same tough, fine grained charcoal iron we used twenty-five years ago; nothing better can be bought at any price. However, we have devised means of insuring a uniformity of product which has permitted a reduction in weight without a decrease in

strength. The metal polishes like glass with proper lubrication and wears slowly and evenly. As there is no counterbore in the front ends, rings are easily "entered." The ends are thickened to prevent splitting; all are bored true and then reamed to exact size by automatic machinery. We use the limit gauge system, which insures duplication to the thousandth part of an inch. Provision is made for thorough lubrication of all wearing parts inside and out, the oil being carried in by the steam or air, and each drill is fitted with an improved oiler. An improved throttle, wearing tight and forged steel wrenches are supplied with each machine.

## Test and Inspection

Every drill must pass a severe test and inspection, being run with air and steam. Parts are strictly interchangeable, fitting perfectly and making the machine new at that point.

Compressor Testing Department

All models work with either steam or air by changing the front head, and drills fit any mounting without changing bolts, as from tripod or quarry bar to tunnel column, etc.; the different mounting taking several sizes of drills for convenience of the user.

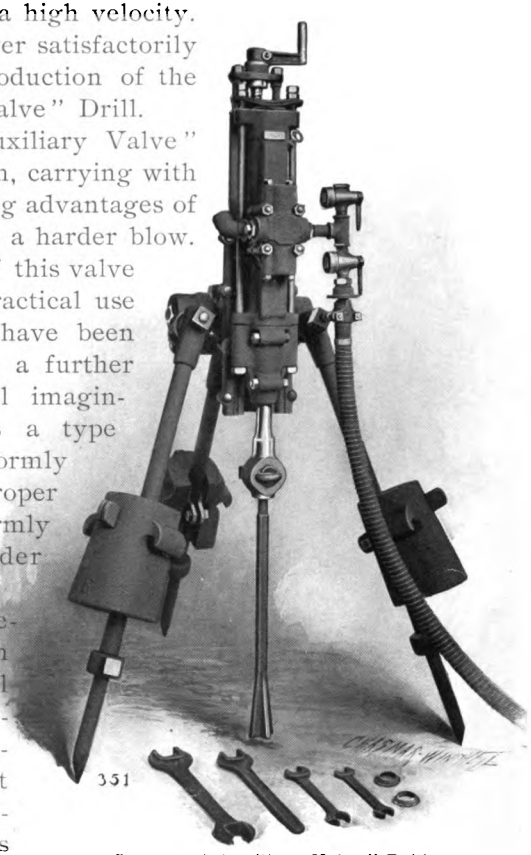
Ample stocks of drills and parts are carried at our works and the different branches all over the world.

Ingersoll-Sergeant Rock Drill in Russia

# The Sergeant "Auxiliary Valve" Drill
## (24 Type)

OLD line engineers are familiar with the many difficulties arising through the use of a tappet which is struck hundreds of thousands of times by a piston moving at a high velocity. These troubles were never satisfactorily overcome until the introduction of the Sergeant "Auxiliary Valve" Drill.

The Sergeant "Auxiliary Valve" was a successful solution, carrying with its construction the strong advantages of the variable stroke with a harder blow. The essential features of this valve motion have been in practical use for many years, and have been steadily improved with a further experience covering all imaginable conditions. It is a type which has been uniformly satisfactory in its proper field of use, and uniformly successful in the harder rocks and ores.



Sergeant "Auxiliary Valve" Drill

The difference between this valve motion and that of the Ingersoll "Eclipse" type is the introduction of a plate between the independent valve chest and the cylinder, which plate carries a lug projecting into the cylinder. In this lug is milled an arc-shaped cut in which slides a light curved steel piece, provided with suitable ports. The sole purpose of this little "auxiliary valve" is to act as a trigger to operate the main valve at just the right time.

The piston in its movement in either direction slides under the curved auxiliary valve and slips it tangentially in

its arc-shaped seat. At the proper time a small port is uncovered and air released from one end or the other of the main valve, which admits the live steam or air under full pressure into the proper end of the cylinder, and drives the piston forward to strike the blow, or back for lifting the piston, as the case may be.

The auxiliary valve is simply a trigger or trip to the main valve. It is held tight upon its seat by the pressure alone, and this causes a uniform wear and insures against leakage. As this auxiliary valve is extremely light, is made of hardest steel and moves on the arc of a circle, it moves easily, without battering or lessening the force of the piston and with very little wear. It is guaranteed against breakage.

"Auxiliary Valve" Chest and Parts

The use of this special auxiliary valve admits of variable stroke, a short one in blocking out the hole to start, thus avoiding "funneling" and "rifling," and a full stroke as soon as the hole is well started. Stroke variation requires no special handling, as it is effected entirely by the feed screw and the operator does not have to bother about any extra regulating valves, as it is only necessary to feed the crank forward for a short stroke or back for the full stroke.

The auxiliary valve is automatic, positive in action, durable, and cannot get out of order. It is perhaps the greatest single improvement in rock drills since the Ingersoll "Eclipse" Drill was produced.

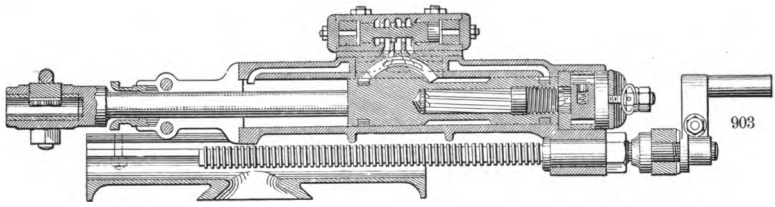
The piston rod and chuck are in one piece, are especially heavy, hardened and ground true. The bearing or guiding surface on cylinders and front head is very great, insuring long life and tight parts.

The spool valve is of the balanced piston type, hardened tool steel and accurately ground. Fitting plug-like, a short travel gives full port opening instantly. We have never known of one breaking. They last indefinitely as wear is practically eliminated. This spool valve, through the delayed action of the auxiliary valve and ports, does not move until the blow is struck, allowing a free exhaust and removing all

cushion; hence the remarkable power of this drill in both striking and pulling and its freedom from sticking in bad ground with bits properly dressed.

The admission is made by other makers, endeavoring to secure this valuable feature of uniform stroke, that in their design wear of parts will lengthen the stroke. As other drills wear and increase the piston travel, the back head must take the punishment with that numbing effect with which runners handling those drills are familiar. Indeed, this often becomes so objectionable as to lead to the use of lead buffers as a partial and unsatisfactory remedy against broken parts.

With our construction, should the auxiliary valve wear in time and lengthen the stroke, it may be replaced at little expense and without the cost of a new piston, cylinder and other



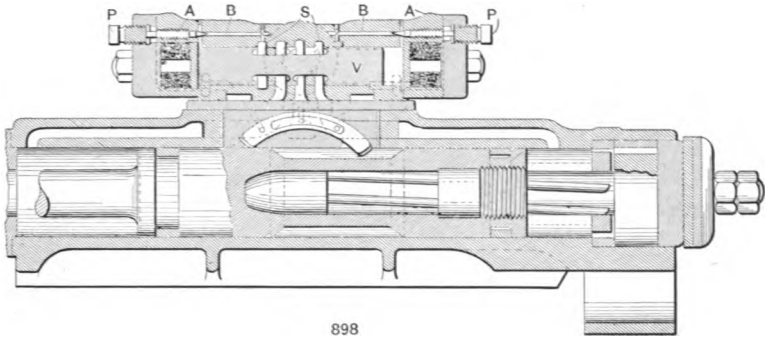

Section of Sergeant "Auxiliary Valve" Drill

only slightly worn parts. In other words, the wear affecting the stroke is confined to one small piece cheaply replaced.

This model has the variable stroke and uncushioned blow. No drill of a given cylinder diameter can strike a harder blow. It is built to stand severe usage for years and to continue striking vicious slugging blows at full stroke and speed after service which would wear out an ordinary drill. It has broken all records for quick work in hard material, in shaft sinking, tunnel and heading driving, etc. It is a fast, economical driller in medium or hard material anywhere. It runs best with compressed air or dry steam. It is the drill sold in large quantities for high grade export trade. The *largest orders* ever placed in the history of the drill business have been for this model after competitive tests of extreme severity. It is a common thing for these drills to run three to five years in limestone quarry work without repairs. Some have been out eight years in active service which have never been out of order an hour. In the more trying classes of drilling it is more economical in repairs than any other drill. Recent improvements make it still more efficient and durable.

It is a common thing for a blacksmith to keep these drills in good order. They will continue to run nearly up to their original capacity long after other makes of spool valve drills, seriously affected by slight wear of parts, have fallen off in efficiency. No pattern will put down a foot of hole with less air, and no machine is more economical where the nature of the material calls for a stunning, dead blow.

## Sergeant Valve Chest (52 Type)




Showing Construction "52" Style Chest

It has been found that the wear of the spool valve in drills using this form of valve, sooner or later, allows the steam or air leakage by the body of the valve at either end to become excessive, when the drill works unequally. Heretofore it has been necessary to renew the valve to overcome this trouble. To obviate this, and in cases where customers wish a valve adjustable for wear, we furnish our 52 type of chest for either C 24, D 24, E 24, F 24 sizes of Sergeant Auxiliary Valve Drills. The operation of this device is as follows :

The 52 chest has a port B, connecting the ends of the valve cylinder with live steam or air from the supply port S. The amount of opening in these discharge passages is controlled by two regulating screws AA, so that just the right amount of steam or air may be admitted at either end to properly operate the main valve V. By adjusting the screws AA, the stroke of the drill can be changed and the machine properly regulated to drill either up, horizontal or down holes. Should a drill after being in use for some time strike the back head or run irregularly, it would be due to the valve V wearing in the chest, in which case steam would leak past the valve V. To reduce this leak turn the regulating screws AA to the right, which restricts the leakage through the ports B and again makes the valve work properly. This regulation can be continued as the valve wears until screws AA are turned down tight, when the chest must either be repaired and a new valve fitted to the same, or a complete new chest must be purchased.

The plug screws PP are intended only to cover and lock the screws AA, so as to keep them from shifting. These should always be put back in place after regulating the valve screws AA, and screwed tight to jam against the top of the adjusting screws AA.

This chest when complete will fit any of the above drills we have shipped, and will be furnished on new drills without extra charge if specified in drill order.

# Descriptive Table of Sergeant "Auxiliary Valve" Rock Drills (24 Type)

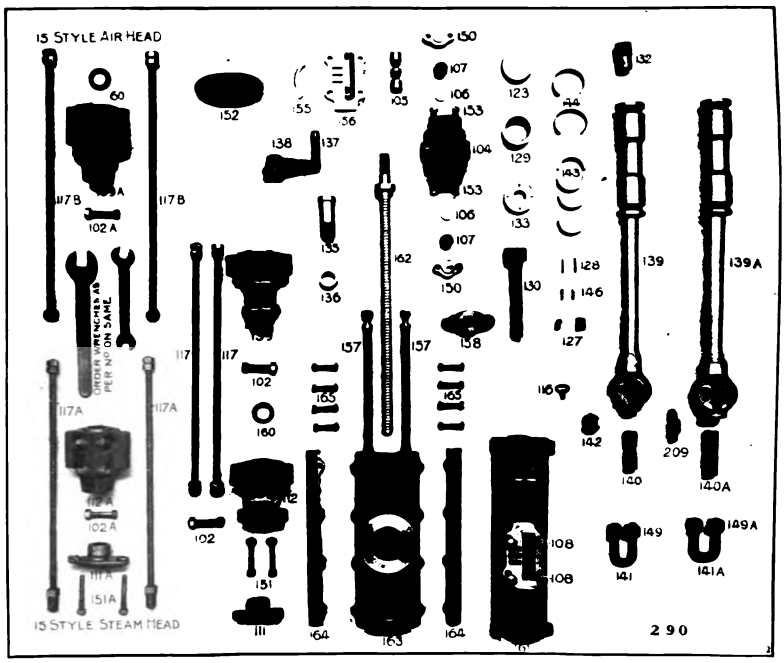
| **Letter and number indicating size and type** | **A 35** | **B 24** | **C 24** | **D 24** | **E 24** | **F 24** |
|---|---|---|---|---|---|---|
| Code name of drill complete with tripod, weights and wrenches (see note) | Salena | Sameb | Semric | Sikrod | Silsie | Sonkof |
| DIMENSIONS: | | | | | | |
| **Diameter of cylinder** ....in. | **2** | **2½** | **2¾** | **3** | **3¼** | **3½** |
| **Length of stroke** ....in. | **5** | **6** | **6½** | **6½** | **6½** | **7** |
| Length of drill from end of crank to end of piston ....in. | 36 | 41 | 48 | 48½ | 49 | 52 |
| Depth of hole drilled without change of bit ....in. | 15 | 20 | 24 | 24 | 24 | 24 |
| Diameter of supply inlet (standard pipe) ....in. | ¾ | ¾ | 1 | 1 | 1 | 1 |
| Approximate strokes per minute with 60 lbs. pressure at drill ..... | 500 | 500 | 375 | 350 | 350 | 300 |
| Approximate weight of blow delivered on rock at each stroke ..lbs. | 250 | 400 | 500 | 550 | 650 | 750 |
| Depth of vertical hole each machine will drill easily, from 1 to.....ft. | 5 | 9 | 10 | 14 | 16 | 20 |
| **Diameter of holes drilled as desired,** from ....in. | **⅝ to 1¼** | **1 to 1½** | **1¼ to 2¼** | **1½ to 2¼** | **1¾ to 2¾** | **1¾ to 3** |
| Average work done per 10 hours in granite down holes, including time lost in setting drill and changing bits ....ft. | 70 | 70 | 70 | 70 | 75 | 75 |
| Diameter of octagon steel used ....in. | ¾ | 1 to ⅞ | 1⅛ to 1 | 1¼ to 1⅛ | 1¼ to 1⅛ | 1⅜ to 1¼ |
| Size of shanks (diameter and lengths) ....in. | 3¾ x ¾ | 4¾ x ⅞ | 5½ x 1 | 5½ x 1⅛ | 5½ x 1⅛ | 5¾ x 1¾ |
| Number of pieces in set of steels to drill holes in depths, as stated .. | 3 | 4 | 5 | 6 | 6 | 8 |
| Best size of boiler to give plenty of steam at high pressure ..... | 5 H. P. | 8 H. P. | 8 H. P. | 8 H. P. | 10 H. P. | 10 H. P. |
| Best size of supply pipe to carry steam 100 to 200 feet ....in. | ¾ | 1 | ¾ | 1 | 1 | 1¼ |
| WEIGHTS: | | | | | | |
| **Drill unmounted, with wrenches and fittings, not boxed** ....lbs. | **100** | **165** | **250** | **265** | **280** | **400** |
| Drill unmounted, with wrenches and fittings, boxed ....lbs | 130 | 200 | 300 | 315 | 330 | 455 |
| Tripod without weights, not boxed ....lbs. | 80 | 160 | 160 | 160 | 210 | 275 |
| Tripod without weights, boxed ....lbs. | 110 | 210 | 210 | 210 | 250 | 335 |
| Holding down weights, not boxed ....lbs. | 120 | 270 | 270 | 285 | 330 | 375 |
| Holding down weights, boxed ....lbs. | 145 | 295 | 295 | 310 | 370 | 450 |
| **Drill, tripod, weights and wrenches, boxed** ....lbs. | **385** | **705** | **805** | **835** | **950** | **1,240** |
| One set of steels, bundled ....lbs. | 133¾ | 64 | 103 | 173 | 173 | 352 |
| One length of hose coupled, boxed ....lbs. | 90 | 105 | 105 | 105 | 105 | 105 |
| SHIPPING MEASUREMENTS (OVER ALL): | | | | | | |
| Box with unmounted drill and fittings ....ft. in. | $3^5$ $1^0$ $0^9$ | $3^{10}$ $1^2$ $0^{10}$ | $4^6$ $1^2$ $0^{11}$ | $4^6$ $1^2$ $0^{11}$ | $4^6$ $1^2$ $0^{11}$ | $4^6$ $1^5$ $1^0$ |
| Box with tripod ....ft. in. | $3^3$ $1^3$ $0^7$ | $4^5$ $1^6$ $0^{10}$ | $4^5$ $1^6$ $0^{10}$ | $4^5$ $1^6$ $0^{10}$ | $4^5$ $1^6$ $0^{10}$ | $4^6$ $1^8$ $0^{10}$ |
| Box with three weights ....ft. in. | $2^1$ $0^{10}$ $0^9$ | $2^7$ $1^0$ $0^{10}$ | $2^7$ $1^0$ $0^{10}$ | $2^8$ $1^2$ $0^{10}$ | $2^8$ $1^2$ $0^{10}$ | $2^{10}$ $1^4$ $1^0$ |
| Box with one length of hose ....ft. in. | $2^8$ $2^8$ $0^6$ | $2^{10}$ $2^8$ $0^6$ | $2^{10}$ $2^8$ $0^6$ | $2^{10}$ $2^8$ $1^6$ | $2^{10}$ $2^8$ $0^6$ | $2^{10}$ $2^8$ $0^6$ |
| PRICES (F. O. B. EASTON OR NEW YORK): | | | | | | |
| Drill unmounted, with wrenches and fittings, without tripod or column | $170.00 | $225.00 | $250.00 | $275.00 | $300.00 | $320.00 |
| Tripod and weights ..... | 30.00 | 50.00 | 50.00 | 50.00 | 50.00 | 55.00 |
| **Drill complete with tripod, wrenches, weights and fittings** ..... | **200.00** | **275.00** | **300.00** | **325.00** | **350.00** | **375.00** |
| One set of steels as usually sent out, not included in price of drill ..... | ..... | ..... | ..... | ..... | ..... | ..... |

NOTE.—*Drill complete* includes drill, throttle, oiler and wrenches, and does not include steels or blacksmith's tools; if mounted, tripod, weights or column and wrenches are included. If drill is wanted *unmounted*, add "s" to code name, thus, SALENA (complete); SALENAS (unmounted, without tripod and weights). **For full information and prices see: Tripods, page 75; columns, page 85; steels, page 60; hose, page 68; blacksmith's tools, page 66.**

# Sergeant "AUXILIARY VALVE" Rock Drill

**Sizes B24, C24, D24, E24, E33, F24**

DUPLICATE PART LIST




| Number and Name of Part | Number and Name of Part | Number and Name of Part |
|---|---|---|
| 102 Front Head Bolts and Nuts | 123 Back Head | 150 Steam Chest Covers |
| 102A Front Head Bolts and Nuts for 15 Style Head | 127 Rotating Pawls | 151 Gland Bolts and Nuts |
| 104 Steam Chest Bare | 128 Pawl Springs | 151A Gland Bolts used with 15 Style Steam Head |
| 105 Valve | 129 Rotating Ratchet | 152 Cushion Springs |
| 106 Valve Washers | 130 Rifle Bar | 153 Chest Cover Studs |
| 107 Valve Buffers | 132 Brass Nut | 154 Washer for Crank |
| 108 Steam Chest Studs and Nut | 133 Rotation Washer | 155 Auxiliary Valve |
| 111 Split Gland | 135 Feed Nut | 156 Auxiliary Valve Seat |
| 111A Split Gland for 15 Style Head | 136 Feed-nut Nut | 157 Standards and Nuts |
| 112 Split Front Head for Steam | 137 Crank | 158 Cross Heads |
| 112A Split Front Head for Steam, 15 Style | 138 Crank Bolt and Nut | 159 Special Front Head (for air only) |
| 116 Thumb Screw [Nuts | 139 Piston Bare [key | 159A Special Front Head (for air only) 15 Style |
| 117 Through Bolts and | 139A Piston Bare using long | 160 Cup Leather |
| 117A Through Bolts and Nuts for 15 Style Steam Heads | 140 Piston Bushing | 161 Square Guide Cylinder Bare |
| 117B Through Bolts and Nuts for 15 Style Air Heads | 140A Piston Bushing used with long key | 162 Feed Screw, Square Thread |
| | 141 U Bolts and Nuts | 163 Shell without Caps |
| | 141A U Bolts and Nuts used with long key | 164 Shell Cap Bolts [Caps |
| | 142 Round Keys | 209 Chuck Key |
| | 143 Piston Rings | |
| | 144 Piston Ring Springs | |
| | 146 Pawl Plunger | |
| | 149 U Bolt Nuts | |
| | 149A U Bolt Nuts used with long key | |

Parts of 52" Chest, see page 39.

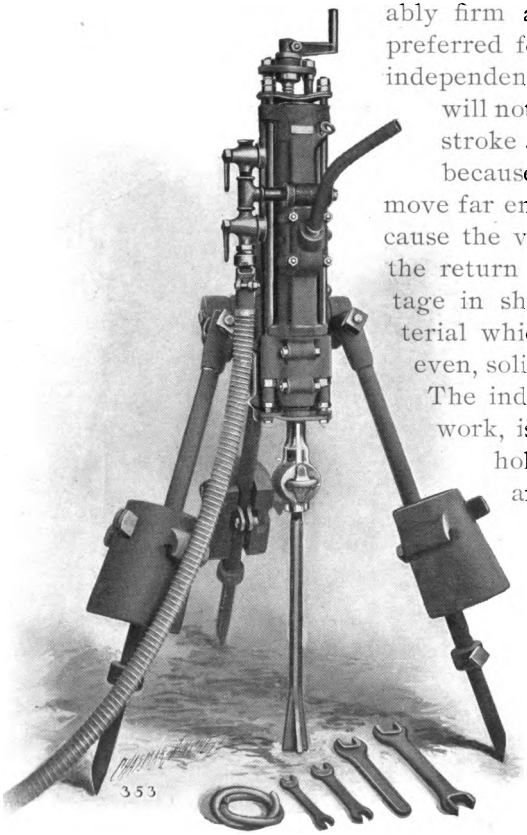
NOTES.—Where the same drill parts are shown a number of times in cut, but in modified forms, letters A, B, etc., are added to the number to distinguish them. Either part can be used on the drill. The 15 style air and steam heads are the latest pattern and can be used on any old drill, providing new through bolts are ordered suitable for the heads.

When ordering duplicate parts always give the SYMBOL of the DRILL (which is cast on the side of the cylinder) and the NUMBER of the DRILL (which is stamped on the front of the cylinder, near the top), also number and name of the parts as per above list.

# Sergeant "Arc Valve" Tappet Drill

## (32 Type)

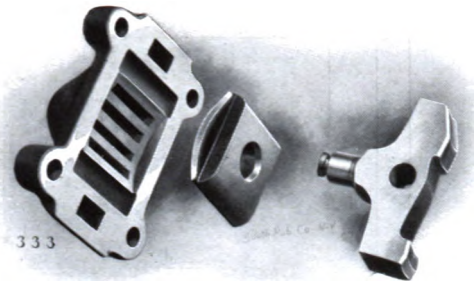
WITH wet steam the tappet drill, because of its positive valve movement, is preferred to other types. It runs better with air or with dry steam, but in some places long steam pipes and serious condensation are unavoidable. When the rock is not hard and is reasonably firm and solid this type may be preferred for open quarry work to the independent valve drill. A tappet drill will not allow of so much variation in stroke as the Sergeant "Auxiliary," because the piston must start and move far enough to work the tappet and cause the valve to uncover the port for the return stroke. This is a disadvantage in shelly or seamy rocks, or material which caves at all badly, but in even, solid rock a full stroke is wanted. The independent valve will do more work, is more durable and will start holes on a glancing face quicker and with less breakage of shanks, but the necessity of using wet steam very often determines the matter in favor of the arc tappet. The arc valve tappet drill strikes a slightly cushioned blow, which is of benefit in some materials as giving an elastic, springy, free action, where a more dead blow would drag.




Sergeant "Arc Valve" Tappet Drill

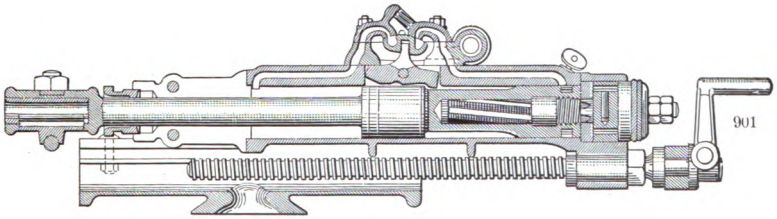
The piston is made with wedge shoulders which slide under the rocker, forward or back, not striking but lifting the valve easily in the same direction as the piston moves. This feature, except for improvement in quality of material and a push spring which

always holds the arc valve against its seat, is much the same as the original Ingersoll-Sergeant Tappet, which has been largely copied. The original tappet drill and others since have used a flat valve, which must move straight in a flat plane, while the rocker arm moves on a curve. These two antagonistic movements and resultant lost motion in the rocker head gouge the seat, break pins, rockers and valves, and soon interfere with the proper working stroke, as any one accustomed to that tappet movement is aware. With the improved "arc valve" we get a shorter, stronger rocker; the valve moves on the same curve as the rocker; the motion is easy, light and free, and the drag, wear and breakage less than with any other tappet type. The valve will not lift off its seat except as a relief valve when water is to be worked out. The pivot or tappet pin is very large and cannot work loose; the rocker is of tool steel, of very wide section, and the valve is held to its seat by the working pressure to take up the wear and hence must remain tight.



Arc Valve, Tappet and Chest

The "New Ingersoll" Improved Chuck is used also on the tappet machine. The piston is hardened and ground, is very heavy and has extra long bearing surfaces. The workmanship and material throughout are up to the standard of all our drills, and the machine more economical in repairs than any other tappet drill. It embodies all the latest general improvements and is the most simple and satisfactory tappet drill yet devised.



Section of Sergeant "Arc Valve" Tappet Drill

# Descriptive Table of Sergeant "Arc Valve" Tappet Rock Drills (32 Type)

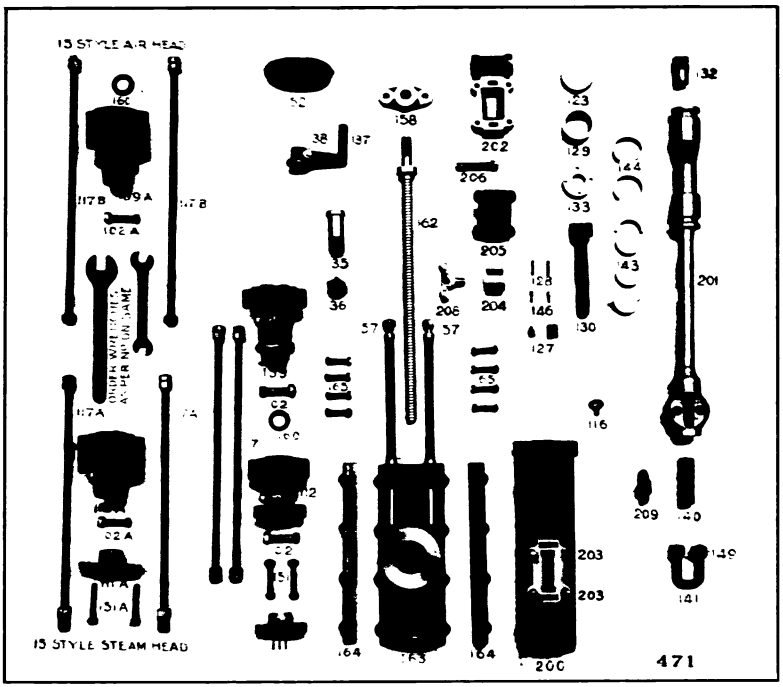
| Letter and number indicating size and type | A 32 | B 32 | C 32 | D 32 | E 32 | F 32 |
|---|---|---|---|---|---|---|
| Code name of drill complete with tripod, weights and wrenches (see note) | Tacora | Talseb | Tamrac | Tafrid | Telme | Tikrif |
| DIMENSIONS: | | | | | | |
| **Diameter of cylinder**.....in. | **2¼** | **2½** | **2¾** | **3⅛** | **3¼** | **3⅝** |
| **Length of stroke**.....in. | **5** | **6** | **6½** | **6⅝** | **6⅝** | **7¼** |
| Length of drill from end of crank to end of piston.....in. | 36 | 43 | 50 | 50 | 50 | 52 |
| Depth of hole drilled without change of bit.....in. | 15 | 20 | 24 | 24 | 24 | 24 |
| Diameter of supply inlet (standard pipe).....in. | ¾ | ¾ | ¾ | 1 | 1 | 1¼ |
| Approximate strokes per minute with 60 lbs. pressure at drill..... | 500 | 450 | 375 | 350 | 325 | 300 |
| Approximate weight of blow delivered on rock at each stroke.....lbs. | 250 | 375 | 500 | 550 | 650 | 750 |
| Depth of vertical hole each machine will drill easily, from 1 to.....ft. | 6 | 5 to 8 | 8 to 10 | 12 to 14 | 14 to 16 | 16 to 20 |
| **Diameter of holes drilled as desired**, from.....in. | **¾ to 1½** | **1 to 1½** | **1½ to 2¼** | **1½ to 2¼** | **1¾ to 2¾** | **1¾ to 3** |
| Average work done per 10 hours in granite down holes, including time lost in setting drill and changing bits.....ft. | 70 | 70 | 70 | 75 | 75 | 75 |
| Diameter of octagon steel used.....in. | ¾ to ⅞ | 1 to ⅞ | 1 to 1⅛ | 1⅛ to 1¼ | 1⅛ to 1¼ | 1¼ to 1⅜ |
| Size of shanks (diameter and lengths).....in. | 3¾ x ¾ | 4¾ x ⅞ | 5½ x 1 | 5½ x 1⅛ | 5½ x 1⅛ | 5¾ x 1¼ |
| Number of pieces in set of steels to drill holes in depths as stated..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Best size of boiler to give plenty of steam at high pressure..... | 6 H. P. | 8 H. P. | 8 H. P. | 9 H. P. | 10 H. P. | 12 H. P. |
| Best size of supply pipe to carry steam 100 to 200 ft.....in. | ¾ | ¾ | ¾ | 1 | 1 | 1¼ |
| WEIGHTS: | | | | | | |
| **Drill unmounted with wrenches and fittings, not boxed**.....lbs. | **128** | **190** | **265** | **315** | **285** | **390** |
| Drill unmounted with wrenches and fittings, boxed.....lbs. | 160 | 245 | 315 | 365 | 332 | 445 |
| Tripod without weights, not boxed.....lbs. | 80 | 160 | 160 | 160 | 210 | 275 |
| Tripod without weights, boxed.....lbs. | 110 | 210 | 210 | 210 | 250 | 335 |
| Holding down weights, not boxed.....lbs. | 120 | 270 | 270 | 285 | 330 | 375 |
| Holding down weights, boxed.....lbs. | 145 | 295 | 295 | 310 | 370 | 450 |
| **Drill, tripod, weights and wrenches, boxed**.....lbs. | **415** | **660** | **820** | **885** | **952** | **1230** |
| One set of steels, bundled.....lbs. | .... | .... | .... | .... | .... | .... |
| One length of hose coupled, boxed.....lbs. | 90 | 105 | 105 | 105 | 105 | 105 |
| SHIPPING MEASUREMENTS (OVER ALL): | | | | | | |
| Box with unmounted drill and fittings.....ft. in. | $3^6\ 1^1\ 0^{10}$ | $4^7\ 0^{11}\ 1^4$ | $4^7\ 0^{11}\ 1^4$ | $4^7\ 0^{11}\ 1^4$ | $4^7\ 0^{11}\ 1^4$ | $4^8\ 1^5\ 1^0$ |
| Box with tripod.....ft. in. | $3^3\ 1^3\ 0^7$ | $4^5\ 1^6\ 0^{10}$ | $4^5\ 1^6\ 0^{10}$ | $4^5\ 1^6\ 0^{10}$ | $4^5\ 1^6\ 0^{10}$ | $4^6\ 1^1\ 0^{10}$ |
| Box with three weights.....ft. in. | $2^1\ 0^{10}\ 0^9$ | $2^7\ 1^0\ 0^{10}$ | $2^7\ 1^0\ 0^{10}$ | $2^8\ 1^2\ 0^{10}$ | $2^8\ 1^2\ 0^{10}$ | $2^{10}\ 1^4\ 1^0$ |
| Box with one length of hose.....ft. in. | $2^8\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ |
| PRICES (F. O. B. EASTON OR NEW YORK): | | | | | | |
| Drill unmounted with wrenches and fittings without tripod or column.. | $170.00 | $200.00 | $225.00 | $250.00 | $275.00 | $295.00 |
| Tripod and weights..... | 30.00 | 50.00 | 50.00 | 50.00 | 50.00 | 55.00 |
| **Drill complete with tripod, wrenches, weights and fittings**..... | **200.00** | **250.00** | **275.00** | **300.00** | **325.00** | **350.00** |
| One set of steels as usually sent out..... | ..... | ..... | ..... | ..... | ..... | ..... |

NOTE.—*Drill complete* includes drill, throttle, oiler and wrenches and does not include steels, hose or blacksmith's tools. If mounted, tripod, weights or column and wrenches are included. If drill is wanted *unmounted* add "s" to code name, thus, TACORA (complete); TACORAS (unmounted without tripod and weights). **For full information and prices see: Tripods, page 75; columns, page 85; steels, page 60; hose, page 68; blacksmith's tools, page 66.**

# Sergeant "ARC VALVE" TAPPET Rock Drill

**Sizes $B^{32}$, $C^{32}$, $C^{34}$, $D^{32}$, $E^{32}$, $F^{32}$**

DUPLICATE PART LIST




| Number and Name of Part | Number and Name of Part | Number and Name of Part |
|---|---|---|
| 102 Front Head Bolt and Nut | 127 Rotating Pawl | 159 Special Front Head (for air only) |
| 102A Front Head Bolt and Nut for 15 Style Head | 128 Pawl Springs | 159A Special Front Head (for air only) for 15 Style Head |
| 111 Split Gland | 129 Rotating Ratchet | 160 Cup Leather |
| 111A Split Gland for 15 Style Head | 130 Rifle Bar | 162 Feed Screw, Square Thread |
| 112 Split Front Head for Steam | 132 Brass Nut | 163 Shell without Caps |
| 112A Split Front Head for Steam for 15 Style Head | 133 Rotating Washer | 164 Square Guide Shell Cap |
| 116 Thumb Screw | 135 Feed Nut | 165 Shell Cap Bolt |
| 117 Through Bolt and Nut | 136 Feed-nut Nut | 200 Cylinder Bare |
| 117A Through Bolt and Nut for 15 Style Steam Head | 137 Crank | 201 Piston Bare |
| 117B Through Bolt and Nut for 15 Style Air Head | 138 Crank Bolt and Nut | 202 Steam Chest |
| 123 Back Head | 140 Piston Bushings | 203 Steam Chest Stud and Nut |
| | 141 U Bolt | 204 Valve |
| | 143 Piston Ring | 205 Valve Seat |
| | 144 Piston Ring Spring | 206 Tappet Pin and Nuts |
| | 146 Pawl Plunger | 208 Tappet |
| | 149 U Bolt Nut | 209 Chuck Key |
| | 151 Gland Bolt and Nut | |
| | 151A Gland Bolt and Nut for 15 Style Head | |
| | 152 Cushion Springs | |
| | 157 Standard and Nut | |
| | 158 Cross-head | |

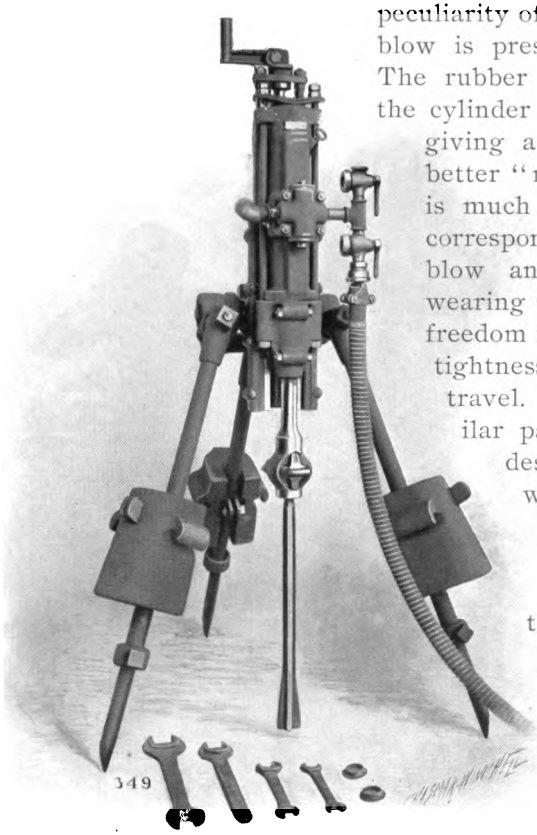
NOTES.—Where the same drill parts are used a number of times in above cut, but in modified forms, letters A, B are added to the numbers to distinguish them. Either part can be used on the drill. The 15 Style air and steam heads are the latest pattern and can be used on any old drill providing new through bolts are ordered suitable for the head.

When ordering duplicate parts always give the SYMBOL of the DRILL (which is cast on the side of the cylinder) and the NUMBER of the DRILL (which is stamped on the front of the cylinder, near the top), also number and name of the parts as per above list.

# The "New Ingersoll" Drill (9 Type)

THIS model is a combination of the best Sergeant features with the valve motion of the Ingersoll "Eclipse," resulting in the development of an improved pattern of great effectiveness, extreme simplicity and increased durability, with several special advantages.

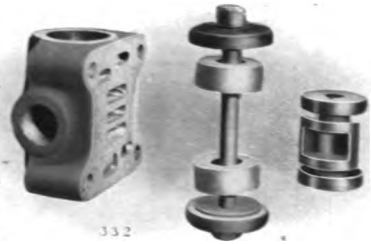
In this design that very evident but indescribable peculiarity of the well known "Eclipse" blow is preserved and improved upon. The rubber buffers are removed from the cylinder and the stroke lengthened, giving a more powerful blow and better "mudding." The piston head is much longer and heavier, with a corresponding increase in force of blow and a considerable gain in wearing surface, insuring durability, freedom from sticking and sustained tightness of parts and full piston travel. The rotation and other similar parts are standard Sergeant design, interchanging freely with all models except the "Eclipse."




"New Ingersoll" Drill

In considering the selection of a drill, a distinction should be made between rocks which are hard and those that are more properly tough—one that will throw a chip and one that will crush. There is a very wide field where this pattern of drill will do more and better work than any other. Old customers who have used our machines in their development through several hundred models in the last thirty years tell us that the "New Ingersoll" is the best drill ever built. No doubt it is in their case, while our "Tappet" or "Auxiliary Valve" might with

equal justice be the "best" in other places. It is certain, however, that the "New Ingersoll" in all its sizes is the best "all around" drill ever built, and the results since its introduction have been uniformly good.

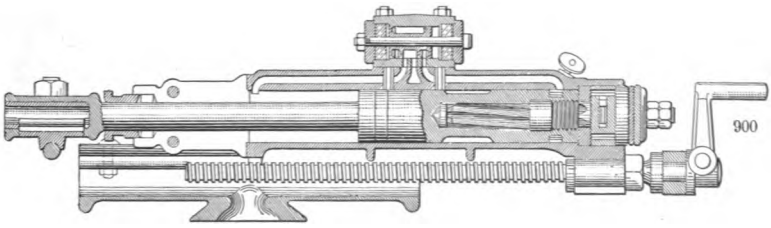


Ingersoll Valve Guide and Chest

It has been improved for the current year, and with reasonably dry steam or compressed air will work well in any material to which percussion drills are suited, hard or soft, solid or blocky. It has a practically uncushioned blow, and the variable stroke so necessary in caving, seamy or broken ground.

Those who use the "Auxiliary Valve" or "Tappet" drill can also use the "New Ingersoll" with little complication of parts, as outside of those special to the valve motions practically all details duplicate in the three models for a given size.

The "New Ingersoll" like the "Sergeant Tappet" uses an improved chuck, U bolt, bushing and chuck key, securing central alignment, longer life and greater strength, and insuring against loosening in hard ground. The improved bushing is much more durable, which is also a gain on the machine wear throughout, since wear in the bushing causes the steel to be drawn slightly to one side, but in line with the piston, instead of throwing the bit off at an angle when the bushing wears, as with other makes. Holes are started more quickly without "cratering," "funneling" or breakage of shanks, and without the reactionary wear on the drill caused by the binding of the steel while rotating. This is a valuable improvement and makes this by far the best rock drill chuck.



Section "New Ingersoll" Drill

# Descriptive Table of "New Ingersoll" Rock Drill (9 Type)

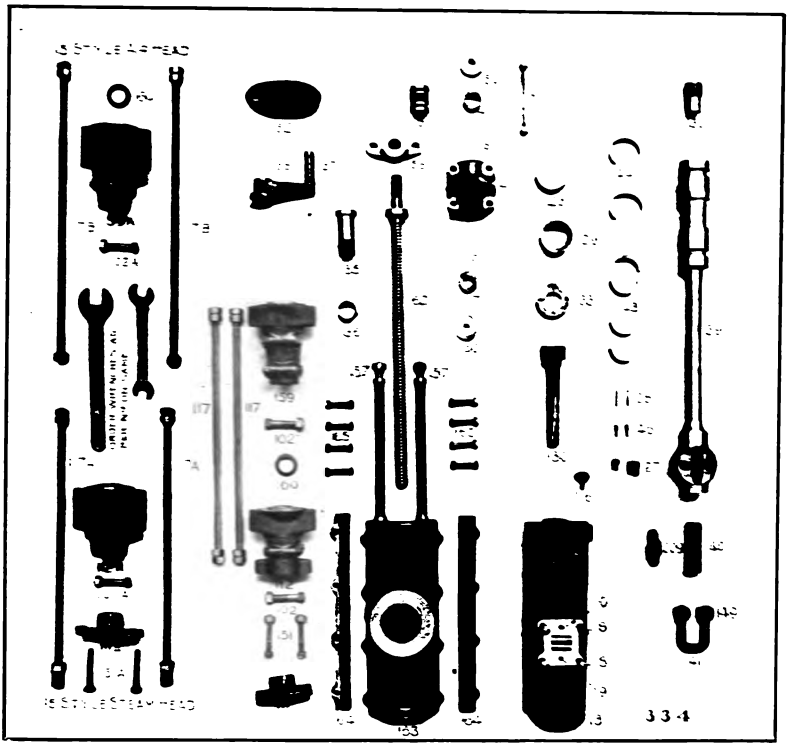
| **Letter and number indicating size and type** | **B 9** | **C 9** | **D 9** | **E 9** | **F 9** | **G 9** | **H 9** |
|---|---|---|---|---|---|---|---|
| Code name of drill complete with tripod, weights and wrenches (see note) | Nabob | Naloc | Nimrod | Ninnie | Nurif | Nusig | Nuvah |
| DIMENSIONS: | | | | | | | |
| **Diameter of cylinder** ..... in. | **2½** | **2¾** | **3⅛** | **3¼** | **3⅝** | **4¼** | **5½** |
| **Length of stroke** ..... in. | **6** | **6½** | **6½** | **6½** | **7** | **9** | **8** |
| Length of drill from end of crank to end of piston ..... in. | 41 | 44 | 48 | 48 | 50 | 58½ | 60 |
| Depth of hole drilled without change of bit ..... in. | 20 | 24 | 24 | 24 | 24 | 30 | 30 |
| Diameter of supply inlet (Standard pipe) ..... in. | ¾ | 1 | 1 | 1 | 1 | 1¼ | 1¼ |
| Approximate strokes per minute with 60 lbs. pressure at drill ..... | 600 | 325 | 325 | 300 | 300 | 250 | 250 |
| Approximate weight of blow delivered on rock at each stroke .. lbs. | 400 | 500 | 625 | 750 | 850 | 1000 | 1800 |
| Depth of vertical hole each machine will drill easily, from 1 to .... ft. | 5 | 10 | 14 | 16 | 20 | 27 | 32 |
| **Diameter of holes drilled as desired, from** ..... in. | **1 to 1½** | **1¼ to 2** | **1¼ to 2½** | **1½ to 3** | **1½ to 3** | **2 to 4** | **3 to 6** |
| Average work done per 10 hours, in granite down holes, including time lost in setting drill and changing bits ..... ft. | 50 | 60 | 70 | 70 | 70 | 70 | 70 |
| Diameter of octagon steel used ..... in. | 1 to ⅞ | 1⅛ to 1 | 1¼ to 1⅛ | 1¼ to 1⅛ | 1⅜ to 1¼ | 1½ to 1⅝ | 1¾ |
| Size of shanks (diameter and lengths) ..... in. | 4¾ x ⅞ | 5½ x 1 | 5½ x 1⅛ | 5¾ x 1⅛ | 5¾ x 1¼ | 6 x 1½ | 7 x 1¾ |
| Number of pieces in set of steels to drill holes in depths as stated .. | 3 | 5 | 7 | 8 | 10 | 11 | 13 |
| Best size of boiler to give plenty of steam at high pressure ..... | 8 H. P. | 8 H. P. | 10 H. P. | 12 H. P. | 12-15 H. P. | 15 H. P. | 18 H. P. |
| Best size of supply pipe to carry steam 100 to 200 ft ..... in. | 1 | 1 | 1 | 1¼ | 1¼ | 1½ | 1½ |
| WEIGHTS: | | | | | | | |
| **Drill unmounted with wrenches and fittings, not boxed** ..... lbs. | **165** | **235** | **255** | **265** | **370** | **575** | **925** |
| Drill unmounted with wrenches and fittings, boxed ..... lbs. | 200 | 275 | 305 | 315 | 425 | .... | 1,100 |
| Tripod without weights, not boxed ..... lbs. | 160 | 160 | 160 | 210 | 275 | 275 | 290 |
| Tripod without weights, boxed ..... lbs. | 210 | 210 | 210 | 250 | 335 | 335 | 360 |
| Holding down weights, not boxed ..... lbs. | 270 | 270 | 285 | 330 | 375 | 375 | 375 |
| Holding down weights, boxed ..... lbs. | 295 | 295 | 310 | 370 | 450 | 450 | 450 |
| **Drill, tripod, weights and wrenches, boxed** ..... lbs. | **705** | **780** | **825** | **935** | **1,210** | **1,375** | **1,870** |
| One set of steels, bundled ..... lbs. | 64 | 140 | 290 | 290 | .... | .... | .... |
| One 50 ft. length of hose coupled, boxed ..... lbs. | 105 | 105 | 105 | 105 | 105 | .... | .... |
| SHIPPING MEASUREMENTS (OVER ALL): | | | | | | | |
| Box with unmounted drill and fittings ..... ft. in. | $3^{10}\ 1^{2}\ 0^{10}$ | $4^{1}\ 1^{2}\ 0^{11}$ | $4^{6}\ 1^{2}\ 0^{11}$ | $4^{6}\ 1^{2}\ 0^{11}$ | $4^{8}\ 1^{5}\ 1^{0}$ | $5^{5}\ 2^{2}\ 1^{5}$ | $5^{5}\ 2^{2}\ 1^{5}$ |
| Box with tripod ..... ft. in. | $4^{5}\ 1^{6}\ 0^{10}$ | $4^{5}\ 1^{6}\ 0^{10}$ | $4^{5}\ 1^{6}\ 0^{10}$ | $4^{5}\ 1^{6}\ 0^{10}$ | $4^{6}\ 1^{8}\ 0^{10}$ | $5^{1}\ 1^{10}\ 0^{11}$ | $5^{1}\ 1^{10}\ 0^{11}$ |
| Box with three weights ..... ft. in. | $2^{7}\ 1^{0}\ 0^{10}$ | $2^{7}\ 1^{0}\ 0^{10}$ | $2^{8}\ 1^{2}\ 0^{10}$ | $2^{8}\ 1^{2}\ 0^{10}$ | $2^{10}\ 1^{4}\ 1^{0}$ | $2^{10}\ 1^{4}\ 1^{0}$ | $2^{10}\ 1^{4}\ 1^{0}$ |
| Box with one length of hose ..... ft. in. | $2^{10}\ 2^{8}\ 0^{6}$ | $2^{10}\ 2^{8}\ 0^{6}$ | $2^{10}\ 2^{8}\ 0^{6}$ | $2^{10}\ 2^{1}\ 0^{6}$ | $2^{10}\ 2^{8}\ 0^{6}$ | $2^{10}\ 2^{8}\ 0^{6}$ | $2^{10}\ 2^{8}\ 0^{6}$ |
| PRICES (F. O. B. EASTON OR NEW YORK): | | | | | | | |
| Drill unmounted with wrenches and fittings, without tripod or column ..... | $225.00 | $250.00 | $275.00 | $300.00 | $325.00 | $365.00 | $700.00 |
| Tripod and weights ..... | 50.00 | 50.00 | 50.00 | 50.00 | 55.00 | 65.00 | 65.00 |
| **Drill complete with tripod, wrenches, weights and fittings** ..... | **275.00** | **300.00** | **325.00** | **350.00** | **375.00** | **430.00** | ~~**700.00**~~ 765 |
| One set of steels as usually sent out ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

NOTE.— *Drill complete* includes drill, throttle, oiler and wrenches, and does not include steels, hose or blacksmith's tools. If mounted tripod, weights and wrenches are included. If drill is wanted *unmounted* add "s" to code name, thus, NABOB (complete) NABOBS (unmounted without tripod and weights). **For full information and prices see: Tripods, page 75; columns, page 85; steels, page 60; hose, page 68; blacksmith's tools, page 66.**

# "NEW INGERSOLL" Rock Drill

## Sizes B, C, D, E, F

PLATE LAST LIST




| Number and Name of Part | | Number and Name of Part | | Number and Name of Part | |
|---|---|---|---|---|---|
| 3 | Valve Guide and Nut | 112A | Split Front Head for Steam 15 Style | 143 | Piston Ring |
| 4 | Valve Chest Bare | 113 | Thumb Screw Nuts | 144 | Piston Ring Spring |
| 5 | Valve | 117 | Through Bolts and Nuts | 145 | Pawl Plunger |
| 6 | Valve Washer | 117A | Through Bolts and Nuts for 15 Style Steam Head | 149 | U Bolt Nut |
| 7 | Valve Buffers | 117B | Through Bolts and Nuts for 15 Style Air Head | 150 | Chuck Bolt and Nut |
| 8 | Steam Chest Studs and Nuts | 120 | Back Head | 150A | Chuck Bolt used with 15 Style Steam Head |
| 9 | Exhaust Port Bushing (front) | 127 | Rotating Pawl | 152 | Cushion Springs |
| 10 | Exhaust Port Bushing (back) | 128 | Pawl Springs | 157 | Shoulder Hand Nut |
| 13 | Cylinder Bare | 129 | Rotating Ratchet | 158 | Cross Head |
| 30 | Piston Bare | 130 | Rifle Bar | 159 | Special Front Head for air only |
| 50 | Steam Chest Cover | 132 | Brass Nut | 159A | Special Front Head for air only 15 Style |
| 102 | Front Heads Bolts and Nuts | 133 | Rotation Washer | 160 | Cup Leather Thread |
| 102A | Front Heads Bolts and Nuts for 15 Style Head | 135 | Feed Nut | 162 | Feed Screw Square |
| 111 | Split Gland | 136 | Feed-nut Nut | 163 | Shell without Cams |
| 111A | Split Gland for 15 Style Head Steam | 137 | Crank | 164 | Square Guide Shell Cap |
| 112 | Split Front Head for | 138 | Crank Bolt and Nut | 165 | Shell Cap Bolt |
| | | 140 | Piston Bushing | 209 | Chuck Key |
| | | 141 | U Bolt | | |

NOTES—Where the same drill parts are shown a number of times in cut, but in modified forms, letters A, B, etc., are added to the numbers to distinguish them. Either part can be used on style drill. The 15 style air and steam heads are the latest pattern and can be used on any old drills provided new through bolts are ordered suitable for the head.

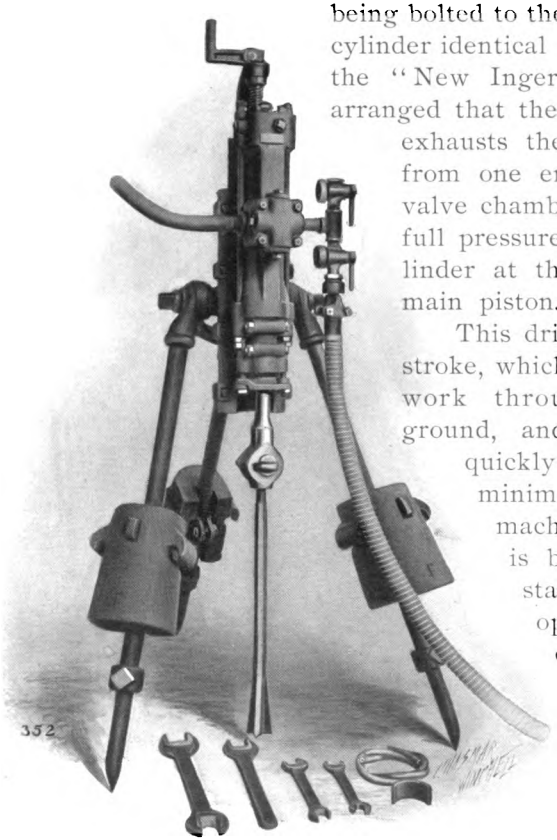
When ordering repair parts always give the SYMBOL of the DRILL which is cast on the side of the cylinder and the NUMBER of the DRILL which is stamped on the front of the cylinder, near the top), also number and name of the parts as per above list.

# The Ingersoll "Eclipse" Drill

THIS pattern is the oldest successful drill employing a "steam moved" valve, and it remains to-day in its improved form as the favorite of many large users.

Operated by either steam or compressed air it constitutes an excellent form of rock drill, the key to its success being *simplicity in construction, durability and great capacity.*

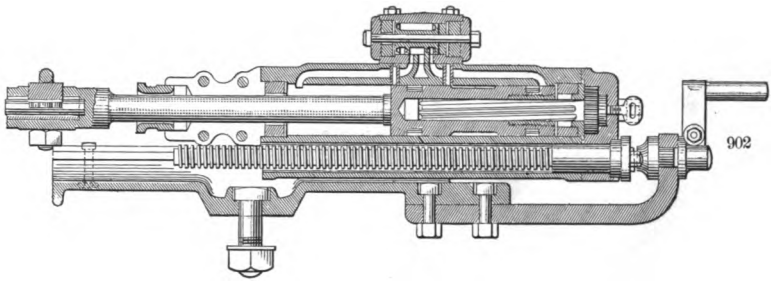
The valve mechanism consists of a chest containing a single moving part, a cylindrical spool valve, the chest being bolted to the front and center of the cylinder identical with the valve action of the "New Ingersoll." The ports are so arranged that the movement of the piston exhausts the accumulated pressure from one end or the other of the valve chamber, which in turn admits full pressure alternately to the cylinder at the top or bottom of the main piston.



Ingersoll "Eclipse" Drill

This drill admits of a variable stroke, which enables the runner to work through seams or caving ground, and also to start a hole quickly in difficult material with minimum wear and tear on the machine. As soon as the hole is blocked out or properly started the throttle may be opened wide and full unecushioned blows delivered.

The "Eclipse" is economical in the use of air or steam and not easily damaged by inexperienced labor. Should a careless runner let the piston strike the head, or the bit penetrate through a seam or pocket and allow the piston to shoot forward, a rubber buffer protects either head of the machine




Section of Ingersoll "Eclipse" Drill

from injury. This makes it possible to feed the drill away from the rock while running without the possibility of damaging itself, sometimes a desirable feature in soft rock or in dry up holes in tunnel work.

Special front heads for steam or air are furnished as desired, the customer specifying choice in this respect.

If wanted and when so ordered, the 3½, 3⅝, 4¼ and 5 inch drills are fitted with an automatic feed, illustrated and described in detail on pages 59.

The "Eclipse" Drill is mounted on Sergeant Tripod, fitted with Ingersoll Saddle, except the 4¼ and 5 inch sizes, which are mounted on quadrant tripods. A three-bolt clamp with Ingersoll Cup Saddle is provided for mounting either on columns.

"Eclipse" Drills at Work

# Descriptive Table Ingersoll "Eclipse" Rock Drills

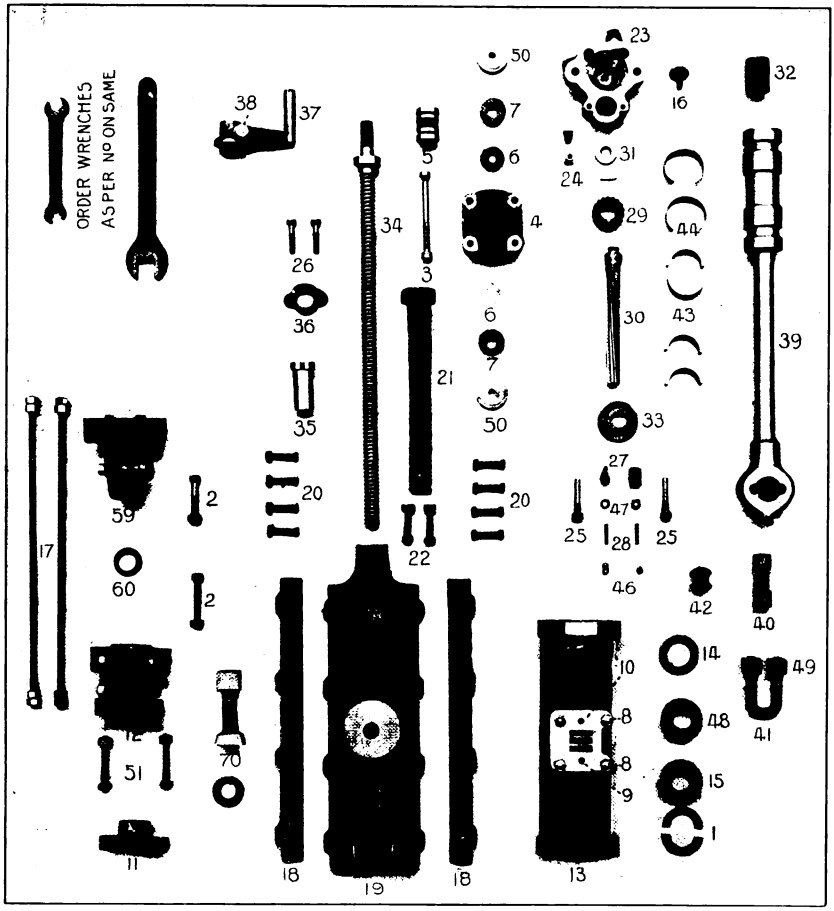
| Letter and number indicating size and type | B 2 | C 6 | E 3 | F 3 (Edorf) FA | G 2 | GA 1 | H 2 | HA 1 |
|---|---|---|---|---|---|---|---|---|
| Code name of drill complete with tripod, weights and wrenches (see note) | Ecabob | Eddic | Egnie | Ekdofa | Emig | Emigea | Enoch | Enochea |
| DIMENSIONS: | | | | | | | | |
| **Diameter of cylinder** ...in. | 2½ | 2¾ | 3 3/16 | 3½ | 4¼ | 4¼ | 5 | 5 |
| **Length of stroke** ...in. | 5 | 5¼ | 6½ | 8 | 7¼ | 8 | 7¼ | 8 |
| Length of drill from end of crank to end of piston ...in. | 42 | 43 | 46 | 65 | 60 | 60 | 60 | 60 |
| Depth of hole drilled without change of bit ...in. | 20 | 24 | 24 | 24 | 30 | 30 | 30 | 30 |
| Diameter of supply inlet (Standard pipe) ...in. | ¾ | 1 | 1 | 1 | 1¼ | 1¼ | 1¼ | 1¼ |
| Approx. strokes per minute with 60 lbs. pressure at drill ... | 360 | 325 | 325 | 275 | 250 | 250 | 250 | 250 |
| Approx. weight of blow delivered on rock at each stroke..lbs. | 350 | 500 | 625 | 750 | 1,000 | 1,500 | 1,500 | 1,500 |
| Depth of vertical hole each machine will drill easily from | 6 | 10 | 14 to 16 | 20 | 27 | 27 | 32 | 32 |
| 1 to ...ft. | | | | | | | | |
| **Diameter of holes drilled as desired, from** ...in. | **1 to 1½** | **1¼ to 2** | **1¼ to 2½** | **1½ to 3** | **2 to 4** | **2 to 4** | **3 to 6** | **3 to 6** |
| Average work done per 10 hours, in granite down holes, including time lost in setting drill and changing bits ...ft. | 50 | 60 | 70 | 70 | 70 | 70 | 70 | 70 |
| Diameter of octagon steel used ...in. | 1 to ⅞ | 1⅛ to 1 | 1¼ to 1⅛ | 1⅜ to ¼ | 1⅝ to 1½ | 1⅝ to 1½ | 1⅝ to 1½ | 1⅝ to 1½ |
| Size of shanks (diameter and lengths) ...in. | 4¾ x ⅞ | 5½ x 1 | 5½ x 1⅛ | 5¾ x 1¼ | 6 x 1½ | 6 x 1½ | 6 x 1½ | 6 x 1½ |
| No. of pieces in set of steels to drill holes in depths as stated.. | 3 | 5 | ..... | 10 | 11 | 11 | 13 | 13 |
| Best size of boiler to give plenty of steam at high pressure ..... | 8 H. P. | 8 H. P. | 10 H. P. | 12-15 H. P. | 15 H. P. | 15 H. P. | 15 H. P. | 15 H. P. |
| Best size of supply pipe to carry steam, 100 to 200 ft ...in. | 1 | 1 | 1 | 1¼ | 1½ | 1½ | 1½ | 1½ |
| WEIGHTS: | | | | | | | | |
| **Drill unmounted with wrenches and fittings, not boxed** ...lbs. | **215** | **244** | **295** | **420** | **665** | **725** | **710** | **815** |
| Drill unmounted with wrenches and fittings, boxed ...lbs. | 255 | 280 | 340 | 475 | 740 | 800 | 885 | 980 |
| Tripod without weights, not boxed ...lbs. | 160 | 160 | 210 | 210 | 325 | 325 | 325 | 325 |
| Tripod without weights, boxed ...lbs. | 210 | 210 | 250 | 250 | 250 | 375 | 375 | 375 |
| Holding down weights, not boxed ...lbs. | 270 | 270 | 330 | 330 | 375 | 375 | 375 | 375 |
| Holding down weights, boxed ...lbs. | 295 | 295 | 350 | 370 | 450 | 450 | 450 | 450 |
| **Drill, tripod, weights and wrenches, boxed** ...lbs. | **760** | **785** | **940** | **1095** | **1565** | **1625** | **1660** | **1805** |
| One set of steels, bundled ...lbs. | .... | .... | .... | .... | .... | .... | .... | .... |
| One length of hose coupled, boxed ...lbs. | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| SHIPPING MEASUREMENTS (OVER ALL): | | | | | | | | |
| Box with unmounted drill and fittings ...ft. in. | $4^1\ 1^3\ 0^{10}$ | $3^{11}\ 1^3\ 0^{11}$ | $4^5\ 1^4\ 0^{11}$ | $4^{10}\ 1^5\ 0^{11}$ | $5^5\ 1^5\ 1^5$ | $5^5\ 1^5\ 1^5$ | $5^5\ 1^7\ 1^6$ | $5^2\ 1^8\ 1^8$ |
| Box with tripod ...ft. in. | $4^5\ 1^6\ 0^{10}$ | $4^5\ 1^6\ 0^{10}$ | $4^5\ 1^6\ 0^{10}$ | $4^5\ 1^6\ 0^{10}$ | $5^5\ 1^{10}\ 1^0$ | $5^5\ 1^{10}\ 1^0$ | $5^5\ 1^{10}\ 1^0$ | $5^5\ 1^{10}\ 1^0$ |
| Box with three weights ...ft. in. | $2^7\ 1^0\ 1^{10}$ | $2^1\ 1^0\ 0^{10}$ | $2^8\ 1^2\ 0^{10}$ | $2^8\ 1^2\ 0^{10}$ | $2^{10}\ 1^4\ 1^0$ | $2^{10}\ 1^4\ 1^0$ | $2^{10}\ 1^4\ 1^0$ | $2^{10}\ 1^4\ 0^{10}$ |
| Box with one length of hose ...ft. in. | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ | $2^{10}\ 2^8\ 0^6$ |
| PRICES (F. O. B. EASTON OR NEW YORK): | | | | | | | | |
| Drill unmounted with wrenches and fittings without tripod or columns | $225.00 | $250.00 | $275.00 | $320.00 | $365.00 | $365.00 | $415.00 | $415.00 |
| Tripod and weights | 50.00 | 50.00 | 50.00 | 55.00 | 65.00 | 65.00 | 65.00 | 65.00 |
| **Drill complete with tripod, wrenches, weights and fittings** | **275.00** | **300.00** | **325.00** | **375.00** | **430.00** | **430.00** | **480.00** | **480.00** |
| One set of steels as usually sent out | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

NOTE.—*Drill complete* includes drill, throttle, oiler and wrenches and does not include steels, hose or blacksmiths' tools; if mounted, tripod or column and wrenches are included. If drill is wanted *unmounted* add "s" to code name, thus ECABOB (complete) ECABOBS (unmounted without tripod and weights). **For full information and prices see: Tripods, page 75; columns, page 85; steels, page 60; hose, page 68; blacksmith's tools, page 66.**

# Ingersoll "ECLIPSE" Rock Drill

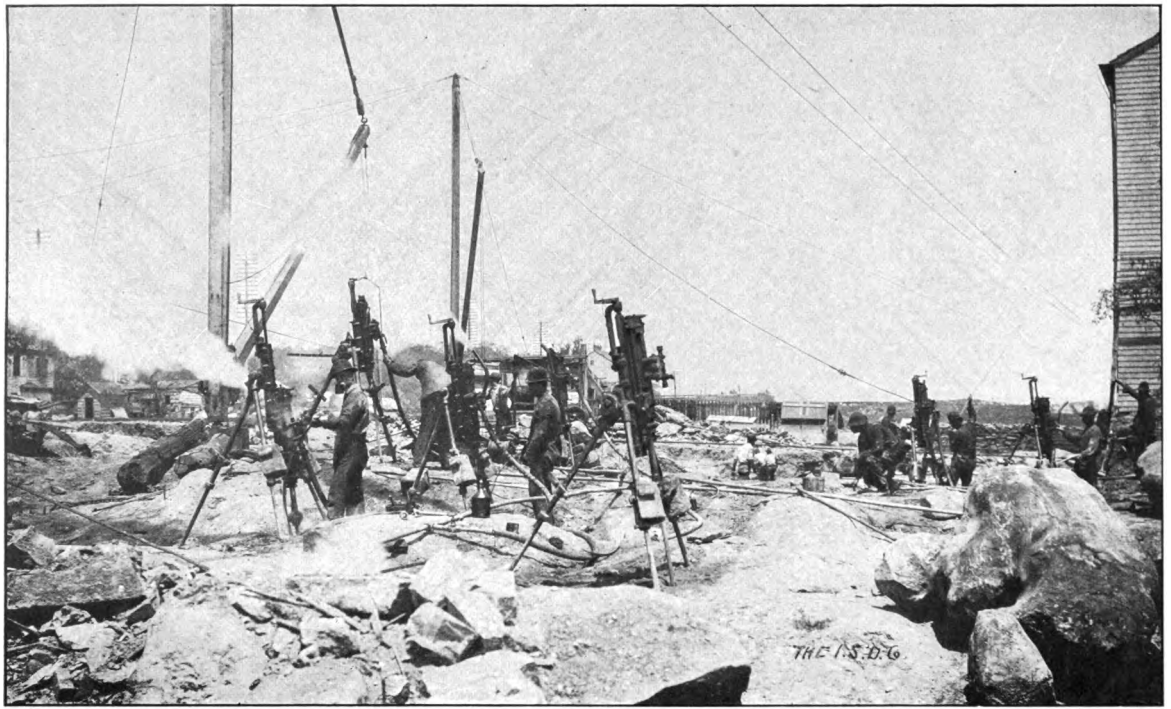
**Standard Sizes $B_2$, $B_7$, $C^6$, $C_7$, $D_4$, $D_7$, $E_3$, $E_7$, $F_3$, $F_7$. Use also for Old "Eclipse" Drills as follows: B, $B^1$, $C^2$, $C_4$, D, $D^1$, $D^2$, E, $E^1$, $E^2$, F, $F^1$, $F^2$**

DUPLICATE PART LIST




| Number and Name of Part | Number and Name of Part | Number and Name of Part |
|---|---|---|
| 1 Front Cylinder Washers | 17 Through Bolts and Nuts | 36 Feed Nut Cap |
| 2 Front Head Bolts and Nuts | 18 Shell Caps | 37 Crank |
| 3 Valve Guide and Nut | 19 Shell without Caps | 38 Crank Bolt and Nut |
| 4 Steam Chest Bare | 20 Shell Cap Bolts | 39 Piston Bare |
| 5 Valve | 21 Goose Neck [Nuts | 40 Piston Bushings |
| 6 Valve Washers | 22 Goose Neck Bolts and | 41 U Bolts and Nuts |
| 7 Valve Buffers [Nuts | 23 Back Head | 42 Round Keys |
| 8 Steam Chest Studs and | 24 Pawl Set Screws | 43 Piston Rings |
| 9 Exhaust Port Bushing (front) | 25 Pawl Bolts | 44 Piston Ring Springs |
| 10 Exhaust Port Bushing (back) | 26 Feed Nut Cap Bolts | 45 Piston Ring Band |
| 11 Split Gland | 27 Rotating Pawls | 46 Pawl Spring Plunger |
| 12 Split Front Head | 28 Pawl Springs | 47 Pawl Washers |
| 13 Cylinder Bare | 29 Rotating Ratchet | 48 Back Cylinder Buffers |
| 14 Back Cylinder Washers | 30 Rifle Bar | 49 U Bolt Nuts |
| 15 Front Cylinder Buffers | 31 Ratchet Nut | 50 Steam Chest Covers |
| 16 Thumb Screw | 32 Brass Nut | 51 Gland Bolts and Nuts |
| | 33 Rotation Washer | 59 Special Front Head for |
| | 34 Feed Screw | 60 Leather [Air |
| | 35 Feed Nut | 70 Back Bolt |

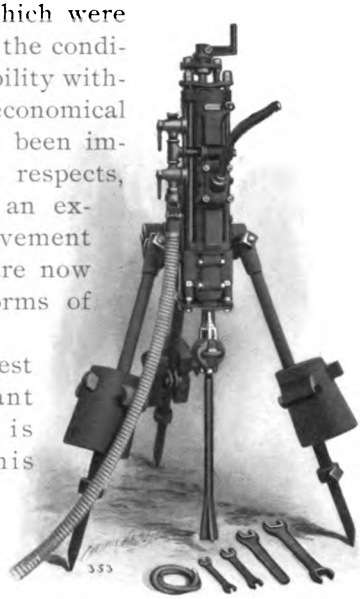
NOTE—When ordering duplicate parts always give the SYMBOL of the DRILL (which is cast on the side of the cylinder) and the NUMBER of the DRILL (which is stamped on the front of the cylinder, near the top), also number and name of the parts as per above list.




Ingersoll-Sergeant Rock Drills at Work

# Ingersoll "Baby" Drill (A 32 Type) and "Light Mining" Drill (A 35 Type)

FOR many purposes a powerful, light weight, high speed, "one man drill" is preferred or necessary. For such cases we advise the use of our "Baby" drill or "Light Mining" drill, both of which were designed several years ago to meet the conditions of lightness and extreme portability without sacrificing rapid, powerful and economical working. These drills have since been improved in a number of important respects, with the knowledge gained from an extensive experience and the improvement in materials of construction and are now offered as the most satisfactory forms of light rock drills.



"Baby" Drill

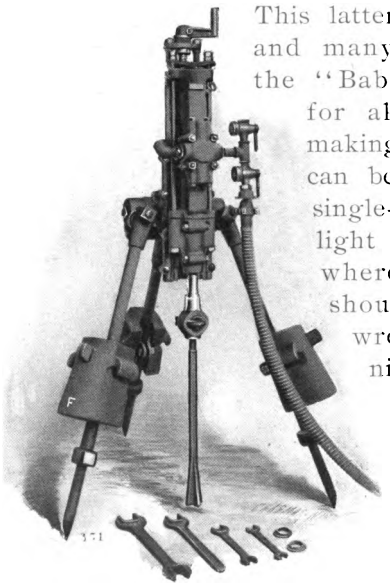
The "Baby" drill is the smallest size of the well known Sergeant "Arc Valve Tappet" drill and is identical in all respects with this form of drill, embodying all of its important features which lends itself to all cases where steam is to be used, and is especially adapted for wet steam. At the same time the "Baby" drill works equally well with compressed air.

The "Light Mining" drill is, in the same manner, the smallest size of standard Sergeant "Auxiliary Valve" drill, the cylinder being 2 inches in diameter against 2¼ inches in the case of the "Baby" drill; the "Light Mining" drill occupies all of the desirable features of the Auxiliary Valve type and is preferred by some. It is primarily an air drill, but is used largely where dry steam is available.

These light drills are favorites in granite, marble or limestone quarries for plug holes, lofting, capping or the stone yards for drilling bolt holes. Frequently they are used in quarries or on contract work for breaking up the large masses thrown down by blasts, as a substitute for the old laborious and expensive method of drilling plug

holes by hand. They are special to anything yet devised. When mounted on a quarry bar or tripod they will put down more hole in a given time than any known means of rock drilling, and remarkable records have been made, running as high as 45 feet of 1⅛ inch hole in 40 minutes. In another case working in limestone, 125 horizontal holes, 1 inch in diameter and 7 feet deep, drilled in 100 minutes, and 150 vertical holes of the same size can be put down in 75 minutes. These are exceptional records, but the average work is far and above which can be done by hand, and one drill frequently does as much work as 10 to 12 men.

Another large field for their use is in sinking small shafts, or for enlarging shafts or tunnels, and trimming walls, roofs, floors or cutting ditches, sumps or drains. More recently they have been adopted by a large number of mining concerns as the standard drill for following veins, where heretofore hand drilling has been necessary. This latter use is becoming most important and many mine operators either now use the "Baby" or the "Light Mining" drill for all stoping work, running raises, making cross cuts, and in fact the drill can be used wherever a man can work single-handed. Either of these drills is so light and compact that it is customary where they are used for miners to shoulder them and carry drill and wrenches about, setting up and running them, without help.



"Light Mining" Drill

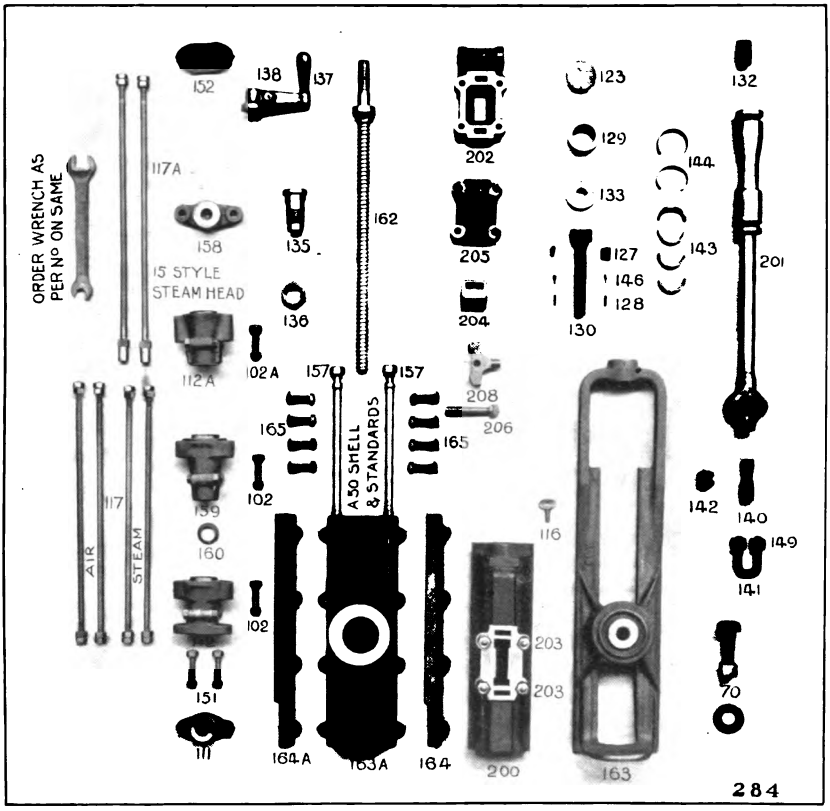
These drills possess remarkable wearing qualities and pay for themselves many times over, their slight first cost amounting to a small factor in the long run.

Experience has shown that three of these small drills can be run on the air required to operate one of the larger 3⅛-inch drills, thus showing that a very small amount of power is required to operate them.

For dimensions and full particulars of the "Baby" drill A32 type, refer to pages 42 and 44, for A35 type "Light Mining" drill refer to pages 36 and 40.

# "BABY" A 32 Sergeant "ARC VALVE" TAPPET
## Rock Drill

DUPLICATE PART LIST



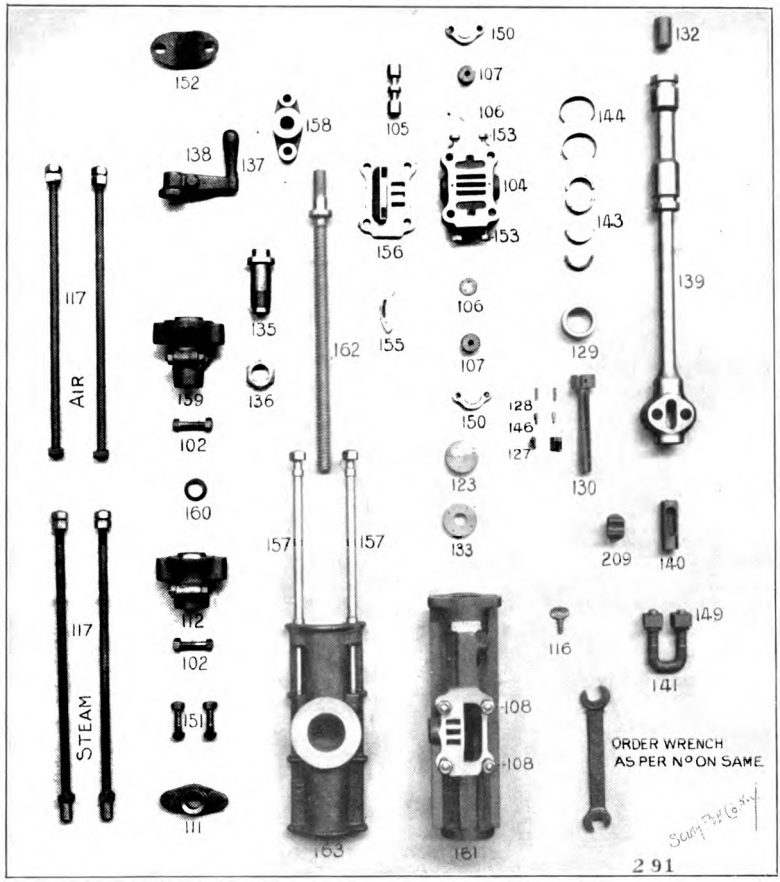

| Number and Name of Part | Number and Name of Part | Number and Name of Part |
|---|---|---|
| 70 Back Bolt | 132 Brass Nut | 159 Special Front Head (for air only) |
| 102 Front Head Bolt and Nut | 133 Rotating Washer | 160 Cup Leather |
| 102A Front Head Bolt and Nut for 15 Style Head | 135 Feed Nut | 162 Feed Screw Sq. Thread |
| 111 Split Gland | 136 Feed-nut Nut | 163 Shell |
| 112 Split Front Head for Steam | 137 Crank | 163A A50 Shell without Caps |
| 112A Split Front Head for Steam, 15 Style | 138 Crank Bolt and Nut | 164 A50 Shell Cap, right hand |
| 116 Thumb Screw | 140 Piston Bushing | 164A A50 Shell Cap, left hand |
| 117 Through Bolts and Nuts | 141 U Bolt | 165 Shell Cap Bolt |
| 117A Through Bolts and Nuts for 15 Style Steam Head | 142 Round Key | 200 Cylinder Bare |
| 123 Back Head | 143 Piston Ring | 201 Piston Bare |
| 127 Rotating Pawl | 144 Piston Ring Spring | 202 Steam Chest |
| 128 Pawl Springs | 146 Pawl Plunger | 203 Steam Chest Stud and Nut |
| 129 Rotating Ratchet | 149 U Bolt and Nut | 204 Valve |
| 130 Rifle Bar | 151 Gland Bolt and Nut | 205 Valve Seat |
| | 152 Cushion Springs | 206 Tappet Pin and Nut |
| | 157 Standard and Nut | 208 Tappet |
| | 158 Cross Head | 209 Chuck Key |

NOTE—When the same drill parts are shown a number of times in above cut, but in modified forms, letters A, B, are added to the numbers to distinguish them. Either part can be used on the drill. The 15 style air and steam heads are the latest pattern and can be used on any old drill providing new through bolts are ordered suitable for the head. The A 50 shell with standards and shell caps is the latest pattern and has Sergeant cone. This shell will fit any A 32 drill that is out, but to use same a Sergeant saddle must be ordered for the tripod or Sergeant clamp for a column fitting.

When ordering duplicate parts always give the SYMBOL of the DRILL (which is cast on the side of the cylinder) and the NUMBER of the DRILL (which is stamped on the front of the cylinder, near the top), also number and name of the parts as per above list.

# "LIGHT MINING" A35 Sergeant "AUXILIARY VALVE" Rock Drill

DUPLICATE PART LIST




| Number and Name of Part | Number and Name of Part | Number and Name of Part |
|---|---|---|
| 102 Front Head Bolts and Nuts | 129 Rotating Ratchet | 152 Cushion Springs |
| 104 Steam Chest Bare | 130 Rifle Bar | 153 Chest Cover Studs |
| 105 Valve | 132 Brass Nut | 154 Washer for Crank |
| 106 Valve Washers | 133 Rotation Washer | 155 Auxiliary Valve |
| 107 Valve Buffers | 135 Feed Nut | 156 Auxiliary Valve Seat |
| 108 Steam Chest Studs and Nuts | 136 Feed-nut Nut | 157 Standards and Nuts |
| 111 Split Gland | 137 Crank | 158 Cross Heads |
| 112 Split Front Head for Steam | 138 Crank Bolt and Nut | 159 Special Front Head (for air only) |
| 116 Thumb Screw | 139 Piston Bare | 160 Cup Leather |
| 117 Through Bolts and Nuts | 140 Piston Bushings | 161 Square Guide Cylinder Bare |
| 123 Back Head | 141 U Bolts and Nuts | 162 Feed Screw, Square Thread |
| 127 Rotating Pawls | 143 Piston Rings | 163 Shell Bare |
| 128 Pawl Springs | 144 Piston Ring Springs | 209 Chuck Key |
| | 146 Pawl Plunger | |
| | 149 U Bolt Nuts | |
| | 150 Steam Chest Covers | |
| | 151 Gland Bolts and Nuts | |

NOTE—When ordering duplicate parts always give the SYMBOL of the DRILL (which is cast on the side of the cylinder) and the NUMBER of the DRILL (which is stamped on the front of the cylinder, near the top), also number and name of parts as per above list.

# The Automatic Feed

THIS attachment is applied only to the larger sizes of the "Eclipse" drills, and is still furnished to old customers preferring that construction for special work when deep holes are to be drilled in homogeneous free cutting material in a down or slightly inclined direction, or where climatic, labor or other conditions favor automatic operation.

Ingersoll Automatic Feed Drill and Shell

Drills fitted with this attachment differ only slightly from the regular "Eclipse" drills, and have in addition to the hand feed a trigger which enters the lower end of the cylinder and is moved by the piston when the cutting advances to a point where the piston approaches too closely to the front head. This trigger connects with the feed ratchet nut which it turns, thus making the piston feed the cylinder forward fast or slow, depending on the character of material and the rate of cutting. As this adds to the complication and cost of repairs it is not advised for general contracting and quarrying work. It also involves the use of an older type of drill without our improvements.

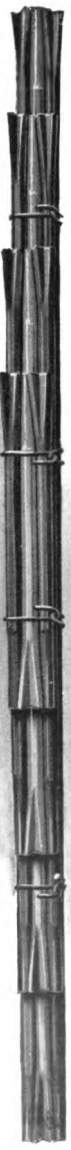
The automatic attachment is furnished only on F, G and H sizes of "Eclipse" drills, which are then called F A, G A 1, H A 1 (old symbols F A, G A and H A). If the automatic feed is wanted it must be specified on order, when it will be furnished without extra cost. Drills so fitted are mounted on the Standard Tripod for that size of drill, unless ordered unmounted.

For dimensions, weights and prices see pages 50 and 52.

# Rock Drill Steels

IN machine drilling with 400 to 600 blows per minute, of from 250 to 1000 pounds each, the service is so severe that only the best grade of tool steel can be used, and even this wears very rapidly, especially in hard rock. This wear, however, is balanced by the fact that for every few feet of advance a longer steel is needed, and in changing to the longer steel a sharp one is substituted and the blunt one is turned over to the blacksmith for dressing. This change about every two feet is necessitated by the fact that a longer feed would make the drill bulky and inconvenient, especially in tunneling and in restricted places.

On this account a set of steels is made up of several steels, the number depending on the final depth and the length of feed of the drill. The shortest is usually about 2 feet long and the others increase by steps of from 12 inches to 30 inches, the average being about 2 feet, up to the longest. To permit one set of bits being sharpened while the other is in use, two or more sets are generally ordered, and these are packed as indicated on the left, but a *set of steels* always means only *one piece of each length* to the depth stated. The black-faced type show what steels are sent on an order when no number or length is specified.



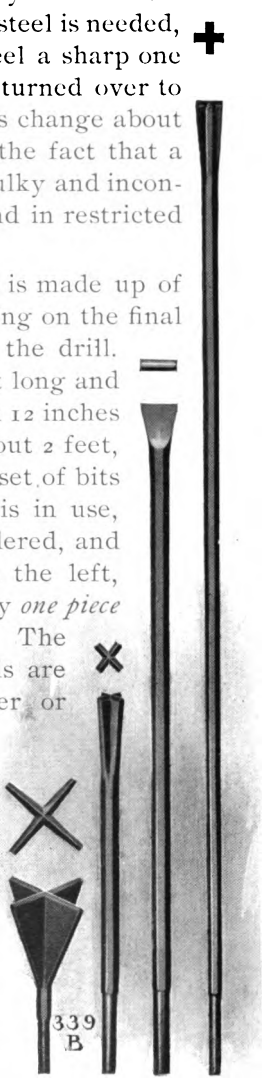
Steels Bundled Ready for Shipment

339 A

## In Ordering Steels

*In ordering, therefore, care should be used to specify whether a set, duplicate set, or single steels are wanted.*

Experience has shown that the cutting edge of the bit should be modified to suit the character of the material being drilled. In sandstone quar-



339 B

Special × Sand Stone +

ries, for example, a flat, blunt bit gives the best results, while in extremely hard and uniform rock the square (+) form works best. In softer material or rock of an irregular or seamy character, but too hard for the flat bit, an ex (×) shaped end works best, as the chance of the cutting edges striking twice in the same place is considerably lessened and the probability of "rifling" or grooving the hole thus made more remote.

These cutting ends are of such form that an ordinary blacksmith can readily forge them from new stock or dress blunt bits. For this purpose we can furnish a special set of "dollies" and "formers," called Blacksmith's Tools, see page 66.

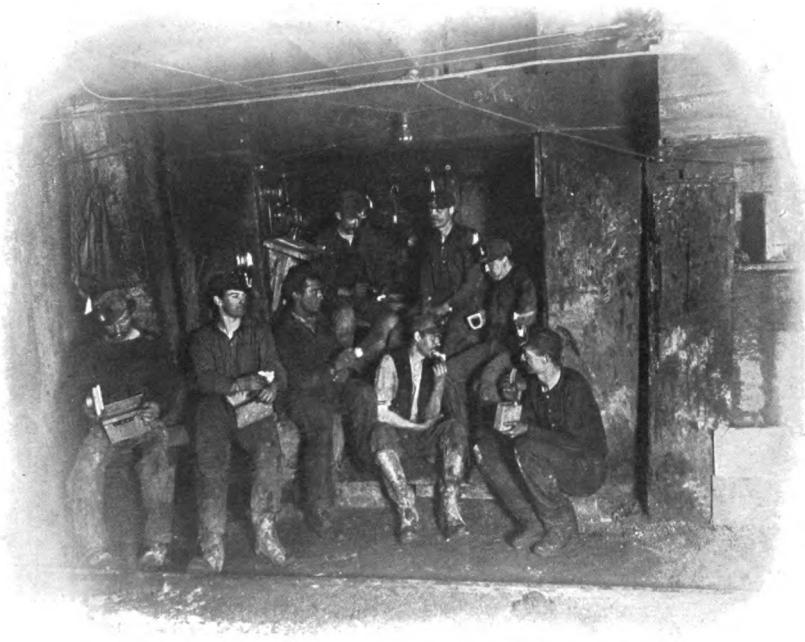
## Care in Sharpening

In drilling, the rate of advance is largely dependent upon the character of the steel, its dressing and its temper. For this reason your blacksmith should be cautioned to take especial pains with each bit to dress and temper it properly. He should work with the drill runners and decide what forging heat, shape and color is best for the rock being drilled. Bits for soft material may be tempered harder than those for working hard rock, because in the latter case the rapid and powerful blows are apt to splinter the steel, unless it is treated to make it tough. Be very careful about overheating or burning the steel. Most complaints may be traced to this abuse, which is naturally denied.

Keep the cutting edges as sharp as the hardness of the material will admit, with the sides immediately above the cutting edges, well back to prevent sticking. If the hole "corners," thicken or blunt the bit a trifle. A bit "just right" may increase the rate of drilling 20 to 50 feet per day.

A little care and observation in each particular case will frequently result in an increase of much more work per day for each drill operated. It is a good rule that bits be as thin and sharp as will not result in sticking, breaking, or rifling or cornering. A slight difference on each blow, multiplied by the millions struck, counts very much in the end. Again, the steels should not drill a larger hole than really necessary. Reducing the diameter often results in 30 per cent. more feet drilled in a given time. Watch the corners for rubbing surface should there be "sticking." The machine never

sticks—it is the bit—and except in crooked holes or when it is caught, sticking is entirely a matter of proper dressing. Care should be used to see that the shanks are made round, smooth and in line with the steel, as a crooked shank throws the drill piston out of line and is apt to cause binding and sticking of drill bit. Besides, a round, true shank is easier to hold tight in the chuck and reduces the wear and tear.



Group of Miners at Bottom of Shaft

# Standard Drill Steels—Sizes, Weights and Prices

## A 24

Shank ¾ x 3¼ Inches
Feed 12 Inches

2-Inch Sergeant "Auxiliary Valve" Drill

| Length of each Steel not Including Shank | Diameter of Standard Bit | Size of Steel | Weights: Each Steel Lbs. | Weights: Set Lbs. | Prices: Each Steel | Prices: Set | Telegraph Name of Set (See Note, page 67) |
|---|---|---|---|---|---|---|---|
| 1′ | 1½″ | ¾″ | 2½ | .... | $1.30 | .... | Damar |
| 2′ | 1⅜″ | ¾″ | 4½ | 7 | 1.54 | $2.34 | Damej |
| 3′ | 1¼″ | ¾″ | 7 | 14 | 1.84 | 4.68 | Danos |
| 4′ | 1⅛″ | ¾″ | 8 | 22 | 1.96 | 6.64 | Dapal |

## A 32 35

Shank ¾ x 3¼ Inches
Feed 15 Inches

2-Inch Sergeant "Auxiliary Valve" "Light Mi..." Drill
2¼-Inch Sergeant "Arc Valve" Tappet "Ba..." Drill

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1′ 3″ | 1½″ | ¾″ | 3 | .... | $1.56 | .... | Dasyp |
| 2′ 6″ | 1⅜″ | ¾″ | 5 | 8 | 1.80 | $3.36 | Datav |
| 3′ 9″ | 1¼″ | ¾″ | 7 | 15 | 2.04 | 5.40 | Dater |
| 5′ | 1⅛″ | ¾″ | 9 | 24 | 2.28 | 7.68 | Datil |
| 6′ 3″ | 1⅛″ | ¾″ | 11 | 35 | 2.52 | 10.20 | Dealb |
| 7′ 6″ | 1⅛″ | ¾″ | 14 | 49 | 2.88 | 13.08 | Dearm |
| 8′ 9″ | 1⅛″ | ¾″ | 18 | 67 | 3.36 | 16.44 | Deasc |
| 10′ | 1⅛″ | ¾″ | 23 | 90 | 3.96 | 20.40 | Debar |

## A 35 50 Special

Shank ⅞ x 4¼ Inches
Feed 15 Inches

2-Inch Sergeant "Auxiliary Valve" Special

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1′ 3″ | 1¾″ | ⅞″ | 4 | .... | $1.68 | .... | Debel |
| 2′ 6″ | 1⅝″ | ⅞″ | 7 | 11 | 2.04 | $3.72 | Debit |
| 3′ 9″ | 1½″ | ⅞″ | 9 | 20 | 2.28 | 6.00 | Debux |
| 5′ | 1⅜″ | ⅞″ | 12 | 32 | 2.64 | 8.64 | Decad |
| 6′ 3″ | 1⅜″ | ⅞″ | 14 | 46 | 2.88 | 11.52 | Decev |
| 7′ 6″ | 1⅜″ | ⅞″ | 16 | 62 | 3.12 | 14.64 | Decim |
| 8′ 9″ | 1⅜″ | ⅞″ | 18 | 80 | 3.36 | 18.00 | Decoi |
| 10′ | 1⅜″ | ⅞″ | 23 | 103 | 3.96 | 21.96 | Decub |

## B 2 9 24 32

Shank ⅞ x 4¼ Inches
Feed 20 Inches

2½-Inch Ingersoll "Eclipse"
2½-Inch "New Ingersoll"
2½-Inch Sergeant "Arc Valve" Tappet

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1′ 8″ | 1¾″ | 1″ | 6 | ... | $1.92 | .... | Dedal |
| 3′ 4″ | 1⅝″ | 1″ | 11 | 17 | 2.52 | $4.44 | Dedec |
| 5′ | 1½″ | ⅞″ | 13 | 30 | 2.76 | 7.20 | Dedid |
| 6′ 8″ | 1⅜″ | ⅞″ | 16 | 46 | 3.12 | 10.32 | Defac |
| 8′ 4″ | 1⅜″ | ⅞″ | 20 | 66 | 3.60 | 13.92 | Defer |
| 10′ | 1⅜″ | ⅞″ | 23 | 89 | 3.96 | 17.88 | Defig |
| 11′ 6″ | 1⅜″ | ⅞″ | 29 | 113 | 4.68 | 22.56 | Defod |

# Standard Drill Steels — Sizes, Weights and Prices

**Black-faced type** refers to "**sets**" which will be shipped when no length is stated.

## A 24

**Shank**
**¾ x 3¼ Inches**
**Feed 12 Inches**

**2-inch Sergeant "Auxiliary Valve" Drill**

| Length of each Steel not Including Shank | Diameter of Standard Bit | Size of Steel | Weights | | Prices | | Telegraph Name of Set |
|---|---|---|---|---|---|---|---|
| | | | Each Steel Lbs. | Set Lbs. | Each Steel | Set | |
| **1'** | **1½"** | **¾"** | **2** | .... | **$1.50** | .... | **Daba** |
| **2'** | **1⅜"** | **¾"** | **4** | **6** | **1.50** | **$3.00** | **Deca** |
| **3'** | **1¼"** | **¾"** | **6** | **10** | **2.00** | **5.00** | **Dida** |
| 4' | 1¼" | ¾" | 8 | 18 | 2.00 | 7.00 | Dofa |

## A 32 35

**Shank**
**¾ x 3¾ Inches**
**Feed 15 Inches**

**2-inch Sergeant "Auxiliary Valve" "Light Mining" Drill**
**2¼-inch Sergeant "Arc Valve" Tappet "Baby" Drill**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1' 3"** | **1½"** | **¾"** | **3** | .... | **$1.50** | .... | **Dabbeea** |
| **2' 6"** | **1⅜"** | **¾"** | **5** | **8** | **1.75** | **$3.25** | **Dabdoa** |
| **3' 9"** | **1¼"** | **¾"** | **7** | **15** | **2.00** | **5.25** | **Dacdea** |
| 5' | 1¼" | ¾" | 9 | 24 | 2.25 | 7.50 | Defgoa |
| 6' 3" | 1¼" | ¾" | 11 | 35 | 2.50 | 10.00 | Duga |
| 7' 6" | 1¼" | ¾" | 13 | 48 | 2.50 | 12.50 | Degdua |
| 8' 9" | 1¼" | ¾" | 15 | 63 | 2.75 | 15.25 | Dekfia |

## A 35 50 Special

**Shank**
**⅞ x 4¾ Inches**
**Feed 15 Inches**

**2-inch Sergeant "Auxiliary Valve" Special**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1' 3"** | **1¾"** | **⅞"** | **5** | .... | **$1.75** | .... | **Deemuua** |
| **2' 6"** | **1⅝"** | **⅞"** | **7½** | **12½** | **2.00** | **$3.75** | **Deepaa** |
| **3' 9"** | **1½"** | **⅞"** | **10** | **23** | **2.25** | **6.00** | **Deesbea** |
| 5' | 1½" | ⅞" | 13 | 36 | 2.50 | 8.50 | Doodena |
| 6' 3" | 1½" | ⅞" | 15½ | 52 | 2.75 | 11.25 | Doofipa |
| 7' 6" | 1½" | ⅞" | 18 | 70 | 3.00 | 14.25 | Dookola |
| 8' 9" | 1½" | ⅞" | 19½ | 90 | 3.50 | 17.75 | Doomuna |

## B 2 9 32

**Shank**
**⅞ x 4¾ Inches**
**Feed 20 Inches**

**2½-inch Ingersoll "Eclipse"**
**2½-inch "New Ingersoll"**
**2½-inch Sergeant "Arc Valve" Tappet**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1' 8"** | **1¾"** | **1"** | **5¾** | .... | **$2.00** | .... | **Dekeb** |
| **3' 4"** | **1⅝"** | **1"** | **10¾** | **16½** | **2.00** | **$4.00** | **Dilob** |
| **5'** | **1½"** | ⅞" | **12½** | **29** | **2.50** | **6.50** | **Domub** |
| 6' 8" | 1½" | ⅞" | 15¾ | 45 | 3.00 | 9.00 | Dunab |
| 8' 4" | 1½" | ⅞" | 19¼ | 64 | 3.50 | 12.50 | Dypeb |

# Standard Drill Steels—Sizes, Weights and Prices—*Cont.*

**Black-faced type** refers to "**sets**" which will be shipped when no length is stated.

## C 6 9 24 32

**Shank**
**1 x 5½ Inches**
**Feed 24 Inches**

**2¼-inch Ingersoll "Eclipse"**
**2¼-inch "New Ingersoll"**
**2¼-inch Sergeant "Auxiliary Valve"**
**2¼-inch Sergeant "Arc Valve" Tappet**

| Length of each Steel not Including Shank | Diameter of Standard Bit | Size of Steel | Weights | | Prices | | Telegraph Name of Set |
|---|---|---|---|---|---|---|---|
| | | | Each Steel Lbs. | Set Lbs. | Each Steel | Set | |
| **2′** | **2¼″** | **1⅛″** | **9½** | .... | **$2.00** | ... | **Deadec** |
| **4′** | **2⅛″** | **1⅛″** | **17½** | **27** | **3.00** | **$5.00** | **Deofic** |
| **6′** | **2″** | **1″** | **19½** | **46½** | **3.00** | **8.00** | **Deykoc** |
| **8′** | **1⅞″** | **1″** | **25** | **71½** | **3.50** | **11.50** | **Debluc** |
| 10′ | 1⅞″ | 1″ | 31 | 102½ | 4.50 | 16.00 | Dedmac |
| 12′ | 1⅞″ | 1″ | 37½ | 140 | 5.00 | 21.00 | Defnec |

These steels are furnished on special order for D drills when bushing is charged to correspond.

## D 9 24 32 E 3 9 24 32

**Shank**
**1⅛ x 5½ Inches**
**Feed 24 Inches**

**3 3/16-inch Ingersoll "Eclipse"**
**3⅛ and 3¼-inch "New Ingersoll"**
**3 and 3¼-inch Sergeant "Auxiliary Valve"**
**3⅛ and 3¼-inch Sergeant "Arc Valve" Tappet**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2′** | **2½″** | **1¼″** | **11½** | .... | **$2.50** | .... | **Dabeod** |
| **4′** | **2⅜″** | **1¼″** | **22** | **34** | **3.00** | **$5.50** | **Dacond** |
| **6′** | **2¼″** | **1⅛″** | **23** | **56** | **3.50** | **9.00** | **Difund** |
| **8′** | **2⅛″** | **1⅛″** | **31** | **87½** | **4.50** | **13.50** | **Dokard** |
| **10′** | **2″** | **1⅛″** | **38½** | **126¼** | **5.00** | **18.50** | **Dulerd** |
| **12′** | **1⅞″** | **1⅛″** | **47** | **173** | **6.00** | **24.50** | **Dymird** |
| 14′ | 1⅞″ | 1⅛″ | 54½ | 227 | 7.00 | 31.50 | Dyrord |
| 16′ | 1⅞″ | 1⅛″ | 62 | 290 | 8.00 | 39.50 | Dysurd |

## F 3 9 24 32

**Shank**
**1¼ x 5¾ Inches**
**Feed 24 Inches**

**3½-inch Ingersoll "Eclipse"**
**3½-inch "New Ingersoll"**
**3½-inch Sergeant "Auxiliary Valve"**
**Sergeant "Arc Valve" Tappet**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2′** | **2⅝″** | **1⅜″** | **14½** | .... | **$2.50** | .... | **Dacbuf** |
| **4′** | **2½″** | **1⅜″** | **22½** | **37** | **3.50** | **$6.00** | **Dacdof** |
| **6′** | **2⅜″** | **1¼″** | **28½** | **65½** | **5.00** | **11.00** | **Dacfif** |
| **8′** | **2¼″** | **1¼″** | **38½** | **104** | **5.50** | **16.50** | **Deokef** |
| **10′** | **2⅛″** | **1¼″** | **47½** | **157½** | **6.00** | **22.50** | **Drilaf** |
| **12′** | **2″** | **1¼″** | **57½** | **209** | **7.00** | **29.50** | **Drimuf** |
| **14′** | **1⅞″** | **1¼″** | **67** | **276** | **8.50** | **38.00** | **Doupof** |
| **16′** | **1¾″** | **1¼″** | **76½** | **352½** | **9.50** | **47.50** | **Dourif** |
| 18′ | 1¾″ | 1¼″ | 86½ | 438 | 10.50 | 58.00 | Dursef |
| 20′ | 1¾″ | 1¼″ | 96 | 525 | 11.50 | 69.50 | Dystif |

## C 6 9 24 32

**Shank**
**1 x 5½ Inches**
**Feed 24 Inches**

**2¾-inch Ingersoll "Eclipse"**
**2¾-inch "New Ingersoll"**
**2¾-inch Sergeant "Auxiliary Valve"**
**2¾-inch Sergeant "Arc Valve" Tappet**

| Length of each Steel not Including Shank | Diameter of Standard Bits | Size of Steel | Weights | | Prices | | Telegraph Name of Set (See Note, page 67) |
|---|---|---|---|---|---|---|---|
| | | | Each Steel Lbs. | Set Lbs. | Each Steel | Set | |
| **2′** | **2¼″** | **1⅛″** | **10** | .... | **$2.40** | .... | **Defum** |
| **4′** | **2⅛″** | **1⅛″** | **17** | **27** | **3.24** | **$5.64** | **Degaz** |
| **6′** | **2″** | **1″** | **20** | **47** | **3.60** | **9.24** | **Degot** |
| **8′** | **1⅞″** | **1″** | **25** | **72** | **4.20** | **13.44** | **Degul** |
| 10′ | 1¾″ | 1″ | 29 | 101 | 4.68 | 18.12 | Dehab |
| 12′ | 1⅝″ | 1″ | 36 | 137 | 5.52 | 23.64 | Dehiv |
| 14′ | 1½″ | 1″ | 42 | 179 | 6.24 | 29.88 | Dejet |
| 16′ | 1½″ | 1″ | 48 | 227 | 6.96 | 36.84 | Dejug |
| 18′ | 1½″ | 1″ | 60 | 287 | 8.86 | 45.70 | Delat |
| 20′ | 1½″ | 1″ | 70 | 357 | 10.06 | 55.76 | Delib |
| 22′ | 1½″ | 1″ | 75 | 432 | 10.66 | 66.42 | Delov |
| 24′ | 1½″ | 1″ | 85 | 517 | 11.86 | 78.28 | Deman |

These steels are furnished on special order for D drills when bushing is charged to correspond

## D 9 24 32 E 3 9 24 32

**Shank**
**1⅛ x 5½ Inches**
**Feed 24 Inches**

**3⅞-inch Ingersoll "Eclipse"**
**3⅛ and 3¼-inch "New Ingersoll"**
**3 and 3¼-inch Sergeant "Auxiliary Valve"**
**3⅛ and 3¼-inch Sergeant "Arc Valve" Tappet**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2′** | **2½″** | **1¼″** | **12** | .... | **$2.78** | .... | **Demed** |
| **4′** | **2⅜″** | **1¼″** | **20** | **32** | **3.74** | **$6.52** | **Demir** |
| **6′** | **2¼″** | **1⅛″** | **24** | **56** | **4.22** | **10.74** | **Dempt** |
| **8′** | **2⅛″** | **1⅛″** | **31** | **87** | **5.06** | **15.80** | **Denas** |
| **10′** | **2″** | **1⅛″** | **40** | **127** | **6.14** | **21.94** | **Dendr** |
| **12′** | **1⅞″** | **1⅛″** | **49** | **176** | **7.22** | **29.16** | **Denud** |
| 14′ | 1¾″ | 1⅛″ | 53 | 229 | 7.70 | 36.86 | Deocc |
| 16′ | 1⅝″ | 1⅛″ | 63 | 292 | 8.90 | 45.76 | Deorn |
| 18′ | 1⅝″ | 1⅛″ | 76 | 368 | 10.78 | 56.54 | Depav |
| 20′ | 1⅝″ | 1⅛″ | 82 | 450 | 11.50 | 68.04 | Depex |
| 22′ | 1⅝″ | 1⅛″ | 88 | 538 | 12.22 | 80.26 | Depur |
| 24′ | 1⅝″ | 1⅛″ | 95 | 633 | 13.06 | 93.32 | Depyg |
| 26′ | 1⅝″ | 1⅛″ | 105 | 738 | 14.26 | 107.58 | Derez |
| 28′ | 1⅝″ | 1⅛″ | 117 | 855 | 15.70 | 123.28 | Derip |
| 30′ | 1⅝″ | 1⅛″ | 130 | 985 | 16.26 | 139.54 | Derob |

## F 3 9 24 32

**Shank**
**1¼ x 5¼ Inches**
**Feed 24 Inches**

**3½-inch Ingersoll "Eclipse"**
**3⅝-inch "New Ingersoll"**
**3½-inch Sergeant "Auxiliary Valve"**
**3⅝-inch Sergeant "Arc Valve" Tappet**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **2′** | **2⅝″** | **1⅜″** | **14** | .... | **$3.02** | .... | **Desaf** |
| **4′** | **2½″** | **1⅜″** | **24** | **38** | **4.22** | **$7.24** | **Desbr** |
| **6′** | **2⅜″** | **1¼″** | **30** | **68** | **4.94** | **12.18** | **Descl** |
| **8′** | **2¼″** | **1¼″** | **38** | **106** | **5.90** | **18.08** | **Desej** |
| **10′** | **2⅛″** | **1¼″** | **49** | **155** | **7.22** | **25.30** | **Desic** |
| **12′** | **2″** | **1¼″** | **57** | **212** | **8.18** | **33.48** | **Desop** |
| **14′** | **1⅞″** | **1¼″** | **68** | **280** | **9.50** | **42.98** | **Desun** |
| **16′** | **1¾″** | **1¼″** | **75** | **355** | **10.34** | **53.32** | **Detax** |
| 18′ | 1¾″ | 1¼″ | 85 | 440 | 11.86 | 65.18 | Deten |
| 20′ | 1¾″ | 1¼″ | 96 | 536 | 13.18 | 78.36 | Dethr |
| 22′ | 1¾″ | 1¼″ | 105 | 641 | 14.26 | 92.62 | Detis |
| 24′ | 1¾″ | 1¼″ | 115 | 756 | 15.46 | 108.08 | Detuv |
| 26′ | 1¾″ | 1¼″ | 125 | 881 | 16.66 | 124.74 | Deung |
| 28′ | 1¾″ | 1¼″ | 140 | 1020 | 18.46 | 143.20 | Deust |
| 30′ | 1¾″ | 1¼″ | 155 | 1175 | 20.26 | 163.46 | Devag |
| 32′ | 1¾″ | 1¼″ | 165 | 1340 | 21.46 | 184.92 | Devin |

**Steels are always furnished with (+) bit. Any other form must be specified in order.**
For prices of special broaching steels and bits for broach channeling add ⅓ to price of regular drill steels of same size and length of shank.

| $G^{2}_{9}{}_{A1}$ $H^{2}_{A1}$ | Shank 1½ x 6½ Inches Feed 30 Inches | | | | 4¼ and 5-inch Ingersoll "Eclipse" 4¼-inch "New Ingersoll" | | |
|---|---|---|---|---|---|---|---|
| Length of each Steel not Including Shank | Diameter of Standard Bit | Size of Steel | Weights | | Prices | | Telegraph Name of Set (See Note Below) |
| | | | Each Steel Lbs. | Set Lbs. | Each Steel | Set | |
| 2′ | 3″ | 1⅝″ | 21 | .... | $5.52 | .... | Devoc |
| 4′ 6″ | 2⅞″ | 1⅝″ | 39 | 60 | 7.68 | $13.20 | Dextr |
| 7′ | 2¾″ | 1½″ | 49 | 109 | 8.88 | 22.08 | Diabl |
| 9′ 6″ | 2⅝″ | 1½″ | 67 | 276 | 11.04 | 33.12 | Diacr |
| 12′ | 2½″ | 1½″ | 84 | 360 | 13.08 | 46.20 | Diant |
| 14′ 6″ | 2⅜″ | 1½″ | 100 | 460 | 16.00 | 62.20 | Diaph |
| 17′ | 2¼″ | 1½″ | 120 | 580 | 18.40 | 80.60 | Dibat |
| 19′ 6″ | 2⅛″ | 1½″ | 136 | 716 | 20.32 | 100.92 | Dicel |
| 22′ | 2″ | 1½″ | 158 | 974 | 23.96 | 124.88 | Dichr |
| 24′ 6″ | 2″ | 1½″ | 176 | 1150 | 26.12 | 151.00 | Dicif |
| 27′ | 2″ | 1½″ | 194 | 1344 | 28.28 | 179.28 | Didem |
| 29′ 6″ | 2″ | 1½″ | 212 | 1556 | 30.44 | 209.72 | Didyn |
| 32′ | 2″ | 1½″ | 230 | 1586 | 32.60 | 242.32 | Diezm |
| 34′ | 2″ | 1½″ | 248 | 1834 | 34.76 | 277.08 | Difam |
| $H^{9}_{17}$ | Shank 1¾ x 7 Inches Feed 30 Inches | | | | 5½-inch "New Ingersoll" Submarine Drill | | |
| 2′ | 3¼″ | 1¾″ | 27 | .... | $8.36 | .... | Difet |
| 4′ 6″ | 3⅛″ | 1¾″ | 48 | 75 | 10.88 | $19.24 | Diffl |
| 7′ | 3″ | 1¾″ | 70 | 145 | 13.52 | 32.76 | Difin |
| 9′ 6″ | 2⅞″ | 1¾″ | 90 | 235 | 15.92 | 48.68 | Difus |
| 12′ | 2¾″ | 1¾″ | 114 | 349 | 18.80 | 67.48 | Diger |
| 14′ 6″ | 2⅝″ | 1¾″ | 136 | 485 | 24.32 | 91.70 | Digit |
| 17′ | 2½″ | 1¾″ | 160 | 645 | 27.20 | 118.90 | Dihex |
| 19′ 6″ | 2⅜″ | 1¾″ | 180 | 825 | 29.60 | 148.50 | Dijud |
| 22′ | 2¼″ | 1¾″ | 204 | 1029 | 35.14 | 183.64 | Dilag |
| 24′ 6″ | 2¼″ | 1¾″ | 232 | 1261 | 38.50 | 222.14 | Dilef |
| 27′ | 2¼″ | 1¾″ | 253 | 1514 | 41.08 | 263.22 | Diluc |
| 29′ 6″ | 2¼″ | 1¾″ | 264 | 1778 | 42.34 | 305.56 | Dimad |
| 32′ | 2¼″ | 1¾″ | 302 | 2080 | 46.90 | 352.46 | Dimen |
| 34′ 6″ | 2¼″ | 1¾″ | 326 | 2406 | 52.44 | 404.90 | Dimov |
| 37′ | 2¼″ | 1¾″ | 350 | 2756 | 55.32 | 460.22 | Dineg |
| 39′ 6″ | 2¼″ | 1¾″ | 374 | 3130 | 58.20 | 518.42 | Dinum |
| 42′ | 2¼″ | 1¾″ | 398 | 3528 | 61.08 | 579.50 | Dioct |

NOTE—A SET CONSISTS OF ONE STEEL OF EACH LENGTH. Each code word, as given in the table, refers to ONE FULL SET up to the length opposite that word.

In ordering drill steels with X bits, Z bits or sandstone bits, add the following to the end of the telegraph words given in these tables: For X bits add "EX"; Z bits add "EZ," and sandstone bits add "ES." Thus, the word "DILAGEX" will mean "set of drill steels for drilling holes 22 feet deep for $H^{9}$ or $H^{17}$ drills with X bits."

For one drill steel with X, Z or sandstone bits, add "ONX," "ONZ" or "ONS," as the case may be.

Steels listed in HEAVY TYPE are STANDARD SIZES and are known as stock steels and will be shipped unless length is specified; all other lengths given in LIGHT TYPE are SPECIAL and are made to order. When a set of steels longer than given in heavy type in above list is ordered, the bit of the longest special steel is made the diameter as given in the table for longest stock steel, and the bit diameters on all shorter steels are increased ⅛ inch for each steel to maintain the same ratio of diameters. All stock steels having the same size shank and length of run are the same regardless of the drill for which used. When ordering steels it is better to order two or more sets so blacksmith can be sharpening one set while other is in use.

# Standard Drill Steels—Sizes, Weights and Prices—*Cont.*

**Black-faced type** refers to "sets" which will be shipped when no length is stated.

| G 2 9 A1 H 2 A1 | Shank 1½ x 6½ Inches Feed 30 Inches | | | | 4¼ and 5-inch Ingersoll "Eclipse" 4¼-inch "New Ingersoll" | | |
|---|---|---|---|---|---|---|---|
| Length of each Steel not Including Shank | Diameter of Standard Bit | Size of Steel | Weights | | Prices | | Telegraph Name of Set |
| | | | Each Steel Lbs. | Set Lbs. | Each Steel | Set | |
| **2'** | **3"** | **1⅜"** | **23** | .... | **$3.50** | ... | **Dusagh** |
| **4' 6"** | **2⅞"** | **1⅝"** | **42** | **65** | **5.00** | **$8.50** | **Doregh** |
| **7'** | **2¾"** | **1½"** | **43** | **108** | **7.50** | **16.00** | **Dupigh** |
| **9' 6"** | **2⅝"** | **1½"** | **56** | **164** | **8.50** | **24.50** | **Dunagh** |
| **12'** | **2½"** | **1½"** | **70** | **234** | **10.00** | **34.50** | **Doiugh** |
| **14' 6"** | **2⅜"** | **1½"** | **84** | **315** | **12.00** | **46.50** | **Dokagh** |
| **17'** | **2¼"** | **1½"** | **96** | **411** | **13.50** | **60.00** | **Dohegh** |
| **19' 6"** | **2⅛"** | **1½"** | **110** | **521** | **15.50** | **75.50** | **Digegh** |
| **22'** | **2"** | **1½"** | **123** | **644** | **17.50** | **93.00** | **Difogh** |
| 24' 6" | 2" | 1½" | 137 | 781 | 19.00 | 112.00 | Didugh |
| 27' | 2" | 1½" | 150 | 931 | 21.00 | 133.00 | Decagh |
| 29' 6" | 2" | 1½" | 163 | 1094 | 23.00 | 156.00 | Debegh |
| 32' | 2" | 1½" | 177 | 1271 | 25.00 | 181.00 | Deaugh |
| **H 9 17** | **Shank 1¼ x 7 Inches Feed 30 Inches** | | | | **5½-inch "New Ingersoll" Submarine Drill** | | |
| **2'** | **3¼"** | **1¾"** | **26** | .... | **$3.50** | ... | **Daabah** |
| **4' 6"** | **3⅛"** | **1¾"** | **48** | **74** | **6.00** | **$9.50** | **Daaceh** |
| **7'** | **3"** | **1¾"** | **69** | **143** | **8.50** | **18.00** | **Daafuh** |
| **9' 6"** | **2⅞"** | **1¾"** | **91** | **234** | **11.00** | **29.00** | **Deedoh** |
| **12'** | **2¾"** | **1¾"** | **113** | **347** | **13.50** | **42.50** | **Deegyh** |
| **14' 6"** | **2⅝"** | **1¾"** | **134** | **481** | **16.00** | **58.50** | **Deekah** |
| **17'** | **2½"** | **1¾"** | **156** | **637** | **18.00** | **76.50** | **Diileh** |
| **19' 6"** | **2⅜"** | **1¾"** | **178** | **815** | **20.50** | **97.00** | **Diimih** |
| **22'** | **2¼"** | **1¾"** | **199** | **1014** | **23.00** | **120.00** | **Diinoh** |
| 24' 6" | 2¼" | 1¾" | 221 | 1235 | 25.50 | 145.50 | Doopuh |
| 27' | 2¼" | 1¾" | 243 | 1478 | 28.00 | 173.50 | Dooraah |
| 29' 6" | 2¼" | 1¾" | 264 | 1742 | 30.00 | 203.50 | Dooseeh |
| 32' | 2¼" | 1¾" | 286 | 2028 | 32.50 | 236.00 | Duutiih |
| 34' 6" | 2¼" | 1¾" | 308 | 2336 | 35.00 | 271.00 | Duuvooh |
| 37' | 2¼" | 1¾" | 330 | 2656 | 37.00 | 308.00 | Duuwuh |
| 39' 6" | 2¼" | 1¾" | 350 | 3006 | 39.50 | 348.50 | Duuxah |
| 42' | 2¼" | 1¾" | 373 | 3379 | 42.00 | 390.50 | Duuyeh |

**Steels are always furnished with (+) bit. Any other form must be specified in order.**

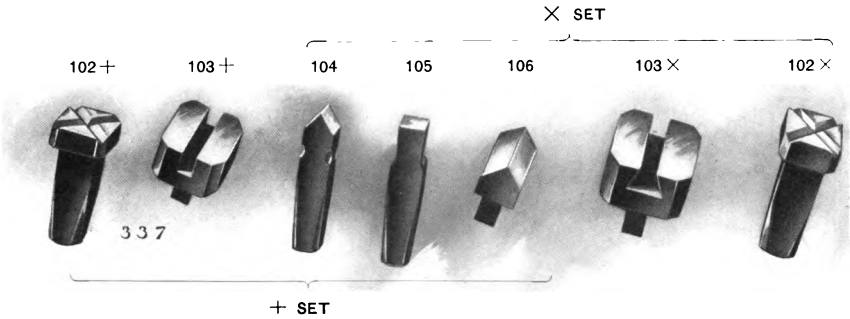
For prices of special broaching steels and bits for broach channeling add ⅓ to price of regular drill steels of same size and length of shank.

NOTE—A SET CONSISTS OF ONE STEEL OF EACH LENGTH. Each code word, as given in the table, refers to ONE FULL SET up to the length opposite that word. If a single steel is wanted add ONE to proper code word, thus "DOURIF" means a set of 8 steels for "F" drill to 16 feet. "DOURIFONE" means ONE 16 foot steel for "F" drill.

Steels listed in HEAVY TYPE are STANDARD SIZES and are known as stock steels; all other lengths given in LIGHT TYPE are SPECIAL and are made to order. When a set of steels longer than given in heavy type in above list is ordered, the bit of the longest special steel is made the diameter as given in the table for longest stock steel, and the bit diameters on all shorter steels are increased ⅛ inch for each steel to maintain the same ratio of diameters. All stock steels having the same size shank and length of run are the same regardless of the drill for which used. When ordering steels it is better to order two or more sets so blacksmith can be sharpening one set while other is in use.

# Blacksmith's Tools

FOR sharpening drill steels a special set of blacksmith's tools is necessary. They will fit any ordinary anvil and may be used by the average blacksmith. These tools are made for ex (X) or square (+) bits and care should be taken to specify which form is wanted when ordering. We make three sizes of each form, one for the A size drills alone, a larger size for all drills from size B to F and the third size for G and H drills. For larger diameters, which are seldom used, special tools must be ordered. One set is sufficient for from one to ten machines.




## Standard Blacksmith's Tools for Sharpening Drill Steels

| Shop Number | Name | Telegraph Name and Price | | | | | |
|---|---|---|---|---|---|---|---|
| | | A Size | | B to F Size | | G and H Size | |
| 102 | Dolly | Dolly | $2.50 | Dalga | $3.00 | Dallo | $4.50 |
| 103 | Sow | Sow | 2.50 | Soula | 2.75 | Soulow | 4.00 |
| 104 | Spreader | Spreader | 1.50 | Spone | 1.50 | Sponor | 2.25 |
| 105 | Flatter | Flatter | 1.25 | Flan | 1.50 | Flande | 2.25 |
| 106 | Swage | Swage | 1.25 | Swala | 1.25 | Swalso | 2.00 |
| Weight of Set .... | | + } × } 16½ lbs. | | + 22 lbs.<br>× 23 lbs. | | + 27 lbs.<br>× 33 lbs. | |
| Telegraph Name } Price of Set..... } | | Amsi | $9.00 | Bamsif | $10.00 | Ganisoh | $15.00 |

Telegraph name refers to (+) set, if (×) set is wanted add EX to beginning of word, thus EXAMSI.

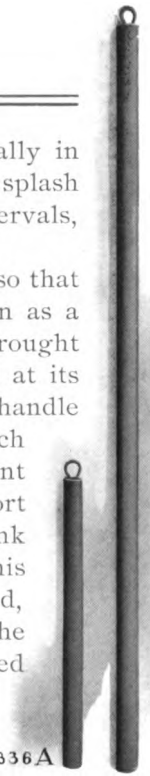
**Swedges for forming shanks on drill steels are not included in SET of Smith tools. Extra price per set, top and bottom, $2.00; separately, $1.25 each. Weight each 3 lbs.**

# Sand Pumps

IN drilling inclined or down holes, and especially in rock that forms a sticky mud which will not splash out, it is necessary to clean out the hole at intervals, usually after each steel, and sometimes oftener.

This is done as a rule when changing steels, so that no time is lost, and for this purpose what is known as a "sand pump" is employed. This is a section of wrought iron tube having at its lower end a valve and at its upper end a bail to which is usually attached a handle consisting of several links of ¼-inch round rod, each perhaps three feet long. These rods have eyes bent at their ends and are linked together, forming a sort of chain. A large ring is fastened to the last link to prevent the chain dropping into the hole. This long link arrangement is better than a solid rod, and is convenient for handling without moving the machine, besides permitting the pump to be pushed to the bottom of the hole.

When it is desirable to clean out holes without moving the machine, the short two-foot pump should be used.



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Sand Pumps

## Sand Pump with Bail

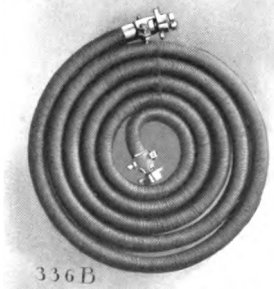
| Outside Diameter in Inches | | No. 1 $1\frac{1}{16}$ inch | | No. 2 $1\frac{5}{16}$ inch | | No. 3 $1\frac{11}{16}$ inch | | No. 4 $1\frac{15}{16}$ inch | | No. 5 $2\frac{3}{8}$ inch | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Standard Sizes | Length | Code Name | Price | Code Name | Price | Code Name | Price | Code Name | Price | Code Name | Price |
| In Stock | 2 ft. | Pilo | $1.00 | Pima | $1.00 | Pire | $1.25 | Posa | $1.50 | Pugo | $2.50 |
| In Stock | 4 ft. | Pabac | 1.50 | Paced | 1.50 | Pedif | 1.75 | Pegol | 2.00 | Pilum | 3.00 |
| To Order | 6 ft. | Pomapa | 2.00 | Popendo | 2.00 | Purisas | 2.25 | Pusoten | 2.50 | Putusil | 3.50 |
| For each additional foot of length add | | 25 cents | | 25 cents | | 25 cents | | 30 cents | | 30 cents | |

NOTE: Above prices are for pump complete with valve and bail, but do not include a chain or rod.

# Air and Steam Hose

THE hose which we furnish is made especially for us of the highest grade seamless tube and the best materials obtainable.

We furnish several sizes, ranging from ¾ inch to 3 inches, with four, five, six or more "plies" of closely woven duck (canvas), coated with the best grade of Para gum mixed with the proper vulcanizing agent and cured to the right degree of density. It is covered in five styles: Plain rubber, canvas covered, canvas covered and marline wound—that is, closely wrapped with a small tarred marline cord—or canvas covered and wire wound, for which purpose a galvanized steel wire is wound around the outside, with about a quarter of an inch between turns. We also furnish a 9-ply linen fabric wire-wrapped hose for air drills or coal cutters, which is very durable.



Marline Wound Hose with Couplings

We suggest the marline wound where steam is to be used, and the wire wound where air is employed. The objection to wire wound in the case of steam is that the wire holds the heat and makes the hose uncomfortable to handle, besides cutting into the duck as the tube expands when heated. The marline wound may be used for either steam or air, and its stretch allows for the swelling of the rubber.

Steam hose may be used for either steam or air, but air hose will not last if used with steam. Oil must never be fed through hose, and steam should be shut out with a tight valve on the end of the pipe line when machine is not in use.

Hose is carried in stock in 25 foot and 50 foot lengths, but is furnished in other lengths and sizes on special orders. Where possible we advise the use of the longer or 50 foot hose, because it permits the machine to be used over a wider range and avoids the loss of time necessary to change the pipe. In many cases when air is employed 100 feet of hose is used on each machine. Hose is not made in longer lengths than 50 feet. Where more is desired two lengths must be coupled together.

# Steam and Air Hose

## Price List

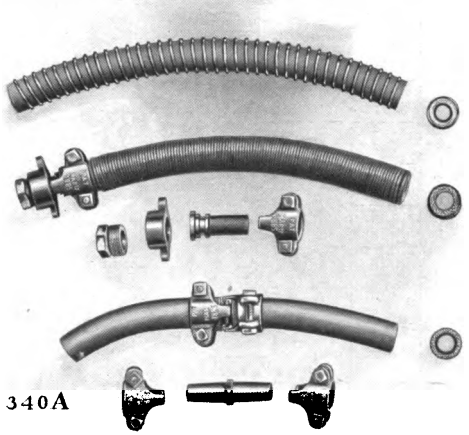
| | Size, Inches | Ply | Price per Foot | Price without Couplings | | Price with Couplings | | Approximate Net Weight One Length with Couplings | | Telegraph Terminals (See roots at bottom of page) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 25 Feet Lengths | 50 Feet Lengths | 25 Feet Lengths | 50 Feet Lengths | 25 Feet Length | 50 Feet Length | |
| Steam Hose—Marline Wound | ¾ | 5 | $0.65 | $16.25 | $32.50 | $19.75 | $36.00 | 31 | 57 | ....oteem |
| | ¾ | 6 | .75 | 18.75 | 37.50 | 22.25 | 41.00 | 36 | 67 | ....otese |
| | 1 | 5 | .80 | 20.00 | 40.00 | 24.00 | 44.00 | 38 | 70 | ....otil |
| | 1 | 6 | .95 | 23.75 | 47.50 | 27.75 | 51.50 | 45 | 84 | ....otoca |
| | 1¼ | 5 | 1.00 | 25.00 | 50.00 | 30.00 | 55.00 | 47 | 86 | ....otoid |
| | 1¼ | 6 | 1.20 | 30.00 | 60.00 | 35.00 | 65.00 | 53 | 98 | ....otome |
| | 1½ | 6 | 1.40 | 35.00 | 70.00 | 42.00 | 77.00 | 62 | 115 | ....otria |
| | 2 | 7 | 2.10 | 52.50 | 105.00 | 63.50 | 116.00 | 89 | 166 | ....ottas |
| Steam Hose—Wire Wound | ¾ | 5 | .70 | 17.50 | 35.00 | 21.00 | 38.50 | 31 | 56 | ....ottez |
| | ¾ | 6 | .80 | 20.00 | 40.00 | 23.50 | 43.50 | 36 | 67 | ....otto |
| | 1 | 5 | .85 | 21.25 | 42.50 | 25.25 | 46.50 | 38 | 70 | ....otudo |
| | 1 | 6 | 1.00 | 25.00 | 50.00 | 29.00 | 54.00 | 44 | 83 | ....oulas |
| | 1¼ | 5 | 1.05 | 26.25 | 52.50 | 31.25 | 57.50 | 48 | 88 | ....oulez |
| | 1¼ | 6 | 1.25 | 31.25 | 62.50 | 36.25 | 67.50 | 53 | 98 | ....oupir |
| | 1½ | 6 | 1.45 | 36.25 | 72.50 | 43.25 | 79.50 | 65 | 120 | ....ourdi |
| | 2 | 7 | 2.15 | 53.75 | 107.50 | 64.75 | 118.50 | 92 | 172 | ....ova |
| Air Hose—*Canvas Covered | ¾ | 5 | .50 | 12.50 | 25.00 | 16.00 | 28.50 | 24 | 43 | ....ovebo |
| | 1 | 5 | .65 | 16.25 | 32.50 | 20.25 | 36.50 | 28 | 51 | ....ovit |
| | 1¼ | 5 | .75 | 18.75 | 37.50 | 23.75 | 42.50 | 38 | 67 | ....oyait |
| Air Hose—*Canvas Covered and Wire Wound | ¾ | 5 | .55 | 13.75 | 27.50 | 17.25 | 31.00 | 31 | 56 | ....ozoan |
| | 1 | 5 | .70 | 17.50 | 35.00 | 21.50 | 39.00 | 37 | 69 | ....ozoic |
| | 1¼ | 5 | .80 | 20.00 | 40.00 | 25.00 | 45.00 | 45 | 81 | ....ualla |
| | 1½ | 6 | 1.15 | 28.50 | 57.00 | 35.50 | 64.00 | 55 | 100 | ....uama |
| | 2 | 7 | 1.75 | 43.75 | 87.50 | 54.75 | 98.50 | 87 | 163 | ....uames |
| Air Hose—Special Linen Fabric | 1 | 9 | .35 | 8.75 | 17.50 | 12.75 | 21.50 | 22 | 38 | ....uans |
| | 1¼ | 9 | .40 | 10.00 | 20.00 | 15.00 | 25.00 | 27 | 45 | ....uaret |
| Air Hose—Special Linen Fabric Wire Wound | 1 | 9 | .40 | 10.00 | 20.00 | 14.00 | 24.00 | 26 | 46 | ....uaris |
| | 1¼ | 9 | .45 | 11.25 | 22.50 | 16.25 | 27.50 | 33 | 58 | ....uassi |
| Exhaust Steam Hose | 1¼ | 4 | .75 | 18.75 | 37.50 | 23.75 | 42.50 | 33 | 58 | ....uator |
| | 1½ | 4 | .95 | 23.75 | 47.50 | 30.75 | 54.50 | 42 | 74 | ....uatum |
| | 2 | 5 | 1.50 | 37.50 | 75.00 | 48.50 | 86.00 | 61 | 109 | ....ubajo |
| Telegraph Roots..... | | | | Zymac | Zynar | Zyson | Zytus | | | |

*Canvas cover counts as one ply.

In ordering hose, combine the root code word at the bottom of the list signifying the length with or without couplings and the terminal code word opposite the size desired.

Unless otherwise stated in the order standard 1-inch 5-ply *steam hose* or 1-inch 4-ply canvas-covered and wire-wound *air hose*, 50 feet long, with couplings on both ends will be sent, but we must know whether steam or air hose is wanted.

In addition to the standard sizes of hose listed in the following table, all of which are carried in stock, we are prepared to furnish special sizes up to 3 inches on short notice. These larger sizes are used in mines and quarries where blasting is going on, and are attached to manifolds or headers with which a number of smaller hose may be connected. See page 74.

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The sizes given in the hose table are what we recommend. In the case of special conditions, or where customer prefers some other size, ply or wrapping, we are prepared to furnish other types of hose.

The prices given are as low as is consistent with high grade goods, and we guarantee our hose to be equal to any on the market.

## Hose Couplings—Prices and Weights

| Size Ins. | Complete with Spud | | | Size Ins. | Spud Alone | | |
|---|---|---|---|---|---|---|---|
| | Price | Weight | Telegraph Name | | Price | Weight | Telegraph Name |
| ½ | $1.50 | 2 lbs. 2 oz. | Pacivira | ½ | $0.25 | 11 oz. | Packhoefen |
| ¾ | 1.75 | 2 lbs. 8 oz. | Packboden | ¾ | .35 | 11 oz. | Packhof |
| 1 | 2.00 | 2 lbs. 12 oz. | Packender | 1 | .40 | 9 oz. | Packhorse |
| 1¼ | 2.50 | 4 lbs. | Packerlohn | 1¼ | .50 | 12 oz. | Packkammer |
| 1½ | 3.50 | 4 lbs. 12 oz. | Packesel | 1½ | .75 | 15 oz. | Packknecht |
| 2 | 5.50 | 6 lbs. 2 oz. | Packetpost | 2 | 1.25 | 1 lb. | Packkosten |
| 2½ | 10.00 | 12 lbs. 4 oz. | Packfond | 2½ | 2.50 | 2 lbs. 12 oz. | Packlack |
| 3 | 14.00 | 14 lbs. 8 oz. | Packhauses | 3 | 3.50 | 3 lbs. | Packleinen |

## Hose Menders—Prices and Weights

| Size | Price | Weight | Telegraph Name |
|---|---|---|---|
| ¾ in. | $1.75 | 2½ lbs. | Packnadel |
| 1 in. | 2.00 | 2¾ lbs. | Packpapier |

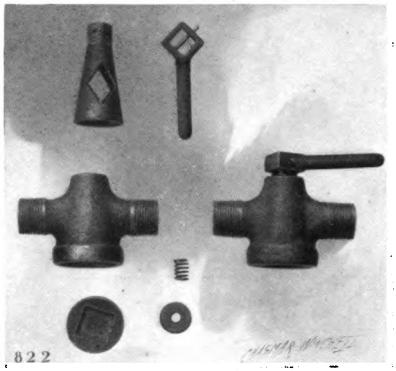
# Steam and Air Hose

| Purpose and Covering | Working Pressure | Size | Ply Inside | Price per Foot of Hose | List Price and Telegraph Name | | | | Net Weight One Length With Couplings | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Without Couplings | | With Couplings and Spuds | | | |
| | | | | | 25 Feet Length | 50 Feet Length | 25 Feet Length | 50 Feet Length | 25 Feet Length | 50 Feet Length |
| Steam Supply—Marline | 100 lbs. | ¾ | 5 | $0.52 | Paardepoot $13.00 | Paaschkoek $26.00 | Packraum **$16.50** | Pabone **$29.50** | 27 | 52 |
| | 125 lbs. | ¾ | 6 | $0.64 | Paardetand $16.00 | Paaschlied $32.00 | Packpferd **$19.50** | Pabonibus **$35.50** | 30 | 58 |
| | 80 lbs. | 1 | 5 | $0.65 | Paarig $16.00 | Paaschmaan $32.00 | Pabellones **$20.00** | Pabonum **$36.00** | 34 | 65 |
| | 100 lbs. | 1 | 6 | $0.78 | Paarung $19.50 | Paaschtijd $39.00 | Pabillorum **$23.50** | Pabulabere **$43.00** | 40 | 76 |
| | 80 lbs. | 1¼ | 5 | $0.78 | Paarweise $19.50 | Paaschvuur $39.00 | Pabillos **$24.50** | Pabularious **$44.00** | 42 | 79 |
| | 100 lbs. | 1¼ | 6 | $1.04 | Paarzeit $26.00 | Paaschweek $52.00 | Pabillum **$31.00** | Pabulorum **$57.00** | 46 | 88 |
| | 100 lbs. | 1½ | 7 | $1.44 | Paarzeiten $36.00 | Paaschzang $72.00 | Pabilo **$43.00** | Pabulosi **$79.00** | 65 | 120 |
| | 100 lbs. | 2 | 8 | $2.20 | Paaschdag $55.00 | Paateiro $110.00 | Pabilones **$66.00** | Pabulosos **$121.00** | 92 | 172 |
| | 100 lbs. | 2½ | 10 | $3.44 | Paaschei $86.00 | Pabellon $172.00 | Pabnyram **$106.00** | Pacacidade **$192.00** | 140 | 255 |
| Steam Exhaust Marline | 80 lbs. | 1¼ | 5 | $0.78 | Pacageons $19.50 | Pacatezza $39.00 | Pacavisset **$23.50** | Paccius **$43.00** | 42 | 79 |
| | 80 lbs. | 1½ | 5 | $1.04 | Pacandorum $26.00 | Pacatianus $52.00 | Paccan **$31.00** | Pacederas **$57.00** | 55 | 100 |
| | 80 lbs. | 2 | 6 | $1.64 | Pacandum $41.00 | Pacativo $82.00 | Pacchiano **$52.00** | Pacedero **$93.00** | 83 | 153 |
| | 80 lbs. | 2½ | 7 | $2.40 | Pacanier $60.00 | Pacato $120.00 | Pacciotta **$80.00** | Pacensa **$140.00** | 117 | 210 |
| Air Supply—Canvas Covered and Wire Wound | 100 lbs. | ¾ | 4 | $0.44 | Pacenses $11.00 | Pachamanca $22.00 | Pachmina **$14.50** | Pachten **$25.50** | 29 | 54 |
| | 100 lbs. | 1 | 4 | $0.49 | Paceremini $12.00 | Pachao $24.00 | Pachola **$16.00** | Pachtest **$28.00** | 35 | 68 |
| | 100 lbs. | 1¼ | 5 | $0.84 | Paceriamos $21.00 | Pacharil $42.00 | Pachomius **$26.00** | Pachtgeber **$47.00** | 49 | 94 |
| | 100 lbs. | 1½ | 5 | $1.01 | Paceriar $25.00 | Pachinus $50.00 | Pachorras **$32.00** | Pachtgeld **$57.00** | 62 | 115 |
| | 100 lbs. | 2 | 6 | $1.56 | Pachacamac $39.00 | Pachirier $78.00 | Pachorrudo **$50.00** | Pachtgut **$89.00** | 83 | 153 |
| | 100 lbs. | 2½ | 7 | $2.24 | Pachalik $56.00 | Pachismo $112.00 | Pachtbrief **$76.00** | Pachthaus **$132.00** | 125 | 225 |
| Air Supply Canvas Covered | 100 lbs. | ¾ | 4 | $0.42 | Pachtherr $10.50 | Pachtkrug $21.00 | Pachtspel **$14.00** | Pachuchada **$24.50** | 23 | 43 |
| | 100 lbs. | 1 | 4 | $0.58 | Pachthofes $14.50 | Pachtlehen $29.00 | Pachtung **$18.50** | Pachycare **$33.00** | 33 | 63 |
| | 100 lbs. | 1¼ | 5 | $0.71 | Pachtjahr $18.00 | Pachtleute $36.00 | Pachtweise **$23.00** | Pachyderme **$41.00** | 39 | 74 |
| | Linen 100 lbs. | 1 | 9 | $0.33 | Pachtkorn $8.00 | Pachtsache $16.00 | Pachtzins **$12.00** | Pachydisse **$20.00** | 19 | 35 |

Prices subject to discount. Prices subject to market changes.

# The Ingersoll-Sergeant Throttle Valve

THIS improved throttle is a great convenience, since it automatically adjusts itself for wear and always remains tight, does not stick, is solid and works free and easy at all times.




Improved Throttle

The port, or opening in the plug, is angled so that a very close adjustment can be made and the drill speed completely controlled by the operator. This valve will not jar open or closed when the drill is running at full speed. Runners should form the habit of throwing the handle opposite ways on alternate days in the interest of uniform wear to prevent leakage and waste of air.

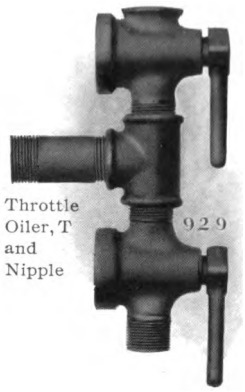
THROTTLE VALVE

| Size | Price | Telegraph Name |
|---|---|---|
| ¾ inch | $2.75 | Valo |
| 1 " | 3.00 | Valen |

## The Ingersoll-Sergeant Oiler

FOR ROCK DRILLS, COAL CUTTERS, PUMPS, HOISTING ENGINES, CHANNELERS, ETC.

This oiler is made of brass and resembles the usual plug cock, and has the plug cupped, or hollowed out, so that when the handle is turned up it can be filled with oil. Turning the handle down swings the opening around and allows the oil to be carried into the machine by the air or steam. This device is extremely simple, durable and most effective, and insures that the oil reaches every part of the machine—a result not attained when oil is poured



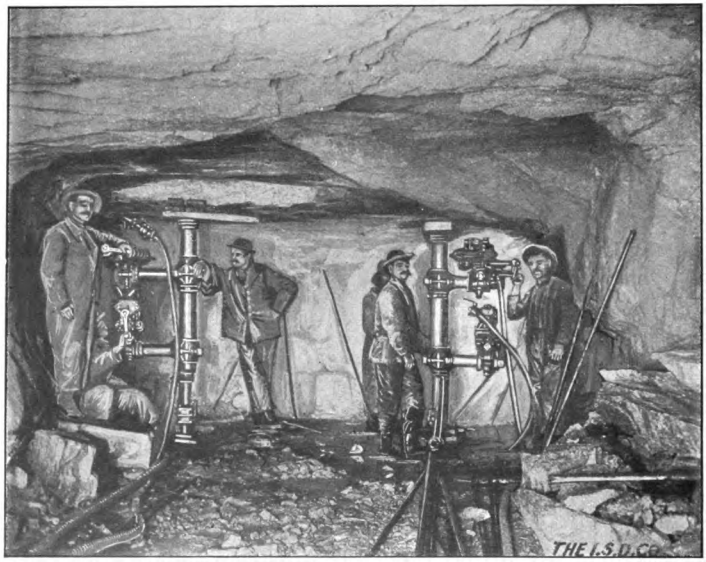
Throttle Oiler, T and Nipple 929

through a plug, as is usually done, because the condensed steam carries or washes it out at the exhaust. With this form the drill can be oiled frequently, using a little at a time.

Oil should not be turned into the drill until the wet steam has worked out by running the steel a little way down, otherwise the water will flush the oil out of the cylinder without any useful effect. The thumb screw near the back head of rock drills should be removed for oiling the rotation from six to ten times per day.

OILER

| Size | Price | Telegraph Name |
|---|---|---|
| ¾ inch | $2.75 | Oido |
| 1 " | 3.00 | Oiden |

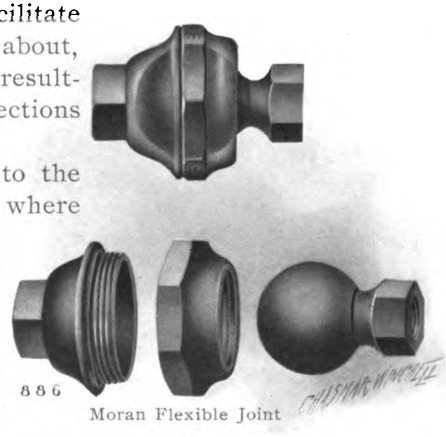



Tunneling, Drills Mounted on Columns, East River, New York City

# Flexible Pipe Joints—Moran Patent

FOR air and steam pipe lines in and about quarries, or for general engineering work, we advocate the use of the Moran Flexible Joint. This joint is especially useful for the working end of pipe lines, as it makes them flexible and easily shifted about. The final connection to the drill should, however, be made with hose. See page 68.

This joint is a ball and socket connection, with a free movement of about 45 degrees in any direction. It is an especially solid form and will last for years under the roughest usage. It is compact, light, adjustable for wear, and forms the most satisfactory joint known where a flexible connection is necessary in a line carrying high pressure steam or air. Its use will facilitate moving the working apparatus about, or will avoid leaks or breakage resulting when pipes with solid connections are used.



Moran Flexible Joint

If the pipe line is exposed to the action of water, or in any case where steam is used, a small sight feed lubricator may be placed on the pipe near the boiler to insure proper lubrication of the joints, and also to insure a longer life to the working machinery, except for drills or other machinery using rubber hose, when oil should be avoided, as it will soon destroy any form of rubber hose.

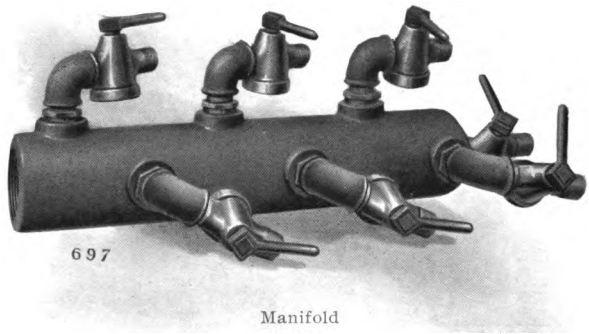
These joints are furnished for all ordinary pressures, and are threaded to fit any standard size of pipe as follows:

| Size of Pipe American Standard | Price | Telegraph Name | Size of Pipe American Standard | Price | Telegraph Name |
|---|---|---|---|---|---|
| ½ in. | $3.25 | Moba | 2 in. | $ 7.50 | Mohop |
| ¾ " | 3.75 | Moce | 2½ " | 9.00 | Mojur |
| 1 " | 4.25 | Modua | 3 " | 11.25 | Mokas |
| 1¼ " | 5.25 | Mofam | 4 " | 15.00 | Molet |
| 1½ " | 6.00 | Mogin | 6 " | 25.00 | Momiv |

# Manifolds or Headers for Air Pipes

IN many cases, such as headings in mines and tunnels, and frequently in quarries and general engineering work, it is necessary to operate several drills in a small space, and a number of hose must be attached to the main supply pipe. For this purpose we furnish a "Manifold." These manifolds are made of 4-inch extra heavy pipe, fitted with a number of cocks to which the hose coupling can be attached.

Each manifold has nipples, elbows and 1-inch throttle valves fitted ready to couple up to the number of drills stated below. There are also two extra holes in the end closed with screw plugs. These manifolds are made in the following sizes:



Manifold

MANIFOLDS OR HEADERS

| Number of Drills for which intended | Weight | Price | | Code Name |
|---|---|---|---|---|
| | | ¾-inch Throttles | 1-inch Throttles | |
| 4 | 45 | $15.50 | $26.50 | Manifo |
| 6 | 50 | 18.00 | 34.25 | Malag |
| 7 | 55 | 19.50 | 38.25 | Mapud |

If manifold is wanted with ¾-inch throttle valves, add "quat" to end of code word above given.

# Mountings

THE rock drill is complete in itself and is so understood by the trade without reference to mounting. It can be used in practically every case where hand drilling is possible. However, different forms of supports are required to meet these different conditions, and on this account we have devised four general styles of mountings—the *Tripod,* the *Column,* single or double screw, the *Gadder* and the *Quarry Bar*, and one or the other of these will meet every requirement under which a rock drill can be operated.

The most frequently used is the tripod, of which we make three types, as follows:


Sergeant Universal Tripod
Complete

## 1. Sergeant Universal Tripod

Our standard tripod, which is copied by others as far as patents will permit, is the Sergeant Universal Joint type. This is the most perfect form yet devised in all respects. It consists of four principal parts, the Sergeant Improved Saddle and three adjustable legs. These are all joined in such manner that each part can be loosened and swung in any direction and clamped independently of any other part. It is the most rigid tripod made. The clamping faces are all cone shaped and of unusually large area, so that a small pressure is sufficient to lock them as

solidly as if cast in the desired position. The cones are so formed that they do not become loose with use.

## Adjustability

Adjustability is, next to strength, the most important requisite of a tripod. In the case of the Sergeant Universal Joint form it would be impossible to improve upon this feature. Each leg is loosened or clamped by but one bolt, when it may be swung in any direction—up, down, in front or back. A single wrench which always goes with each tripod fits the nuts of all bolts and also the chuck nuts of the drill.

All the legs are telescopic and the sliding ends are pointed and tapered so that they may never slip and let the drill fall over. They can be shortened or lengthened by slacking one set screw and are of such length as to accommodate themselves to the most irregular ground. The weight hooks or clamp hangers can be adjusted up or down on the legs, or the operator may stand on the hangers for convenience in operating. The holding down weights in this way are clear of the extension set screws and the legs may be adjusted without removing them.

The weights have a rounded back and two comfortable lifting handles, which make them easy to lift and carry about on the shoulder. This tripod takes any of the Ingersoll-Sergeant Drills; but if the Ingersoll Saddle is wanted to use with Ingersoll Drills it must be especially ordered. This tripod is made in four sizes, described in the accompanying table, page 82.

## Durability

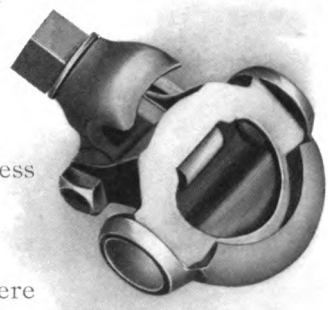
All bolts and nuts used are standard and unlike others in that any blacksmith may repair or make them, and as the few parts used are made unusually heavy there is practically no wear of the tripod, and the yearly repair item of this part of an outfit amounts to nothing. A tripod often outwears many drills.

## The Sergeant Saddle

This type of saddle is an improvement on other forms in that it is extremely simple and solid, and admits of the drill being removed from the tripod by simply slacking

off a clamp screw without change of bolts or other parts. The weight of the drill and the strains when running rest on and are referred to a solid projecting hook on the saddle and not on a hook bolt. Greater adjustability is also obtained. The saddle cone fitting this clamp is reversed, so that the base rests in the clamp. This makes the shell more rigid and insures against any shifting in position while running. Again, when cleaning face holes in mining, changing steels or in case of a crooked hole, the drill will swing back to correct alignment.

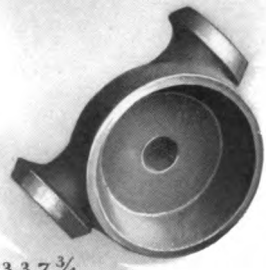
This form is the Standard Tripod Saddle, and is shipped in all cases unless otherwise specified.



Sergeant Reverse Cone Saddle

## Ingersoll Saddle

The older forms of rock drills were not intended for such universal use as experience has demonstrated this type of labor saving machine to be applicable to, and as a result the form of mounting used on the earlier drill was not sufficiently adjustable to meet all the requirements of the present day. The Ingersoll Tripod is still made to fill the wants of those using Ingersoll Drills, and for those who continue to call for this form on account of its remarkable rigidity and the satisfaction it gives for heavy drills working on inclined or down holes in quarries or railway work.



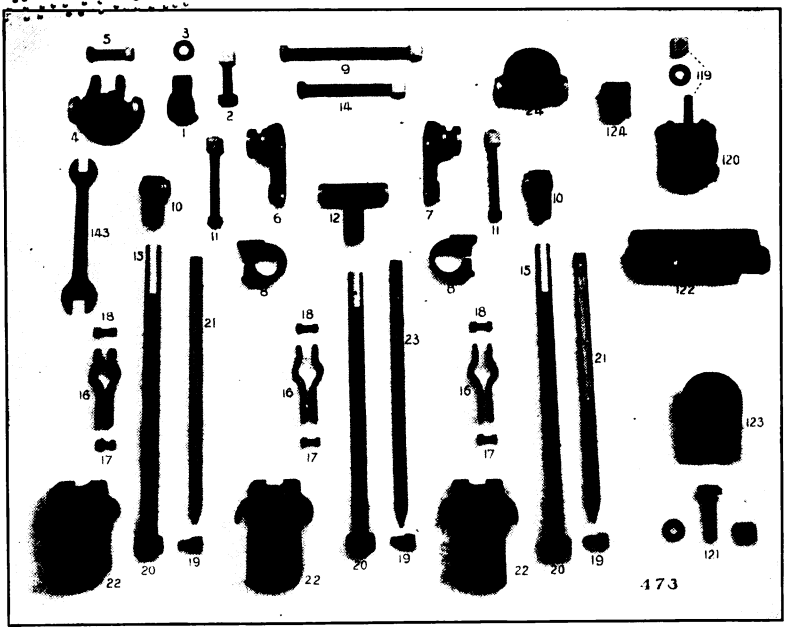
337¾ Ingersoll Cone Saddle

The saddle of this tripod has a cone-shaped cup into which a projecting cone on the back of the Ingersoll Drill shell fits. A bolt extends through saddle and cone and clamps the drill shell firmly in position. This saddle is still a favorite and is copied largely by other makers.

# SERGEANT TRIPOD

## Sizes, A35, D24, E24, and F24

DUPLICATE PART LIST




| Number and Name of Part | Number and Name of Part | Parts for Lewis Hole Tripod |
|---|---|---|
| | | Number and Name of Part |
| 1 Jaw | 14 Back Leg Bolt and Nut | 119 Jaw Stud and Nut |
| 2 T Bolt and Nut | 15 Front Leg Pipe | 120 Sliding Saddle (Sergeant) |
| 3 T Bolt Washer | 16 Weight Hanger | 121 Sliding Saddle Bolt, Nut and Washer |
| 4 Saddle | 17 Weight Hanger Short Bolt | 122 Saddle Frame |
| 5 Jaw Bolt and Nut | 18 Weight Hanger Long Bolt | 123 Sliding Saddle (Ingersoll) |
| 6 Hip—Round Hole | 19 Pointer Set Screw | 124 Jaw for Sliding Saddle (Sergeant) |
| 7 Hip—Square Hole | 20 Set Screw Band | 143 Wrench |
| 8 Hip Ring | 21 Front Leg Pointer | |
| 9 Saddle Bolt and Nut | 22 Weight | |
| 10 Front Leg Top Piece | 23 Back Leg Pointer | |
| 11 Front Leg Bolt and Nut | 24 Ingersoll Saddle | |
| 12 Back Leg Tee | | |
| 13 Back Leg Pipe | | |

NOTE—The Sergeant Tripod is considered standard for all drills. The Sergeant "Auxiliary Valve" Drill, the "New Ingersoll" Drill and the "Arc Valve" Tappet Drill all have Sergeant Cones and use the Sergeant Saddle. The Ingersoll "Eclipse" Drill has Ingersoll Cone and uses Ingersoll Saddle. If Lewis Hole parts are wanted they should be specified.

When ordering duplicate parts always give SIZE and SYMBOL of DRILL for which tripod is used, also NUMBER and name of part, as per above list.

The above tripods are used for different size drills, as follows:

A35 tripod is used for 2 and 2¼ inch drills.

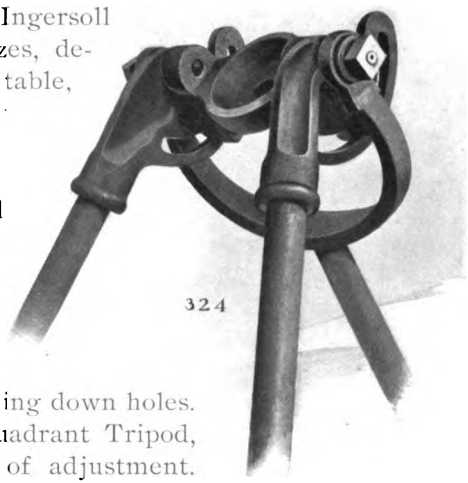
D24 tripod is used for 2½, 2¾, 3 and 3⅛ inch drills.

E24 tripod is used for 3¼ inch drills.

F24 tripod is used for 3½ and 3⅝ inch drills.

## 2. Ingersoll Tripod

We also continue to make the old Ingersoll Tripod, which is a solid and satisfactory form in all cases where extreme adjustability is not the most desired feature. It works especially well in general quarrying and railway work for vertical or inclined down holes. We supply this *only on special orders* to meet the requests of old customers. For regular service we recommend our "Universal" Tripod. The Ingersoll Tripod is made in three sizes, described in the accompanying table, page 82.



Quadrant Tripod

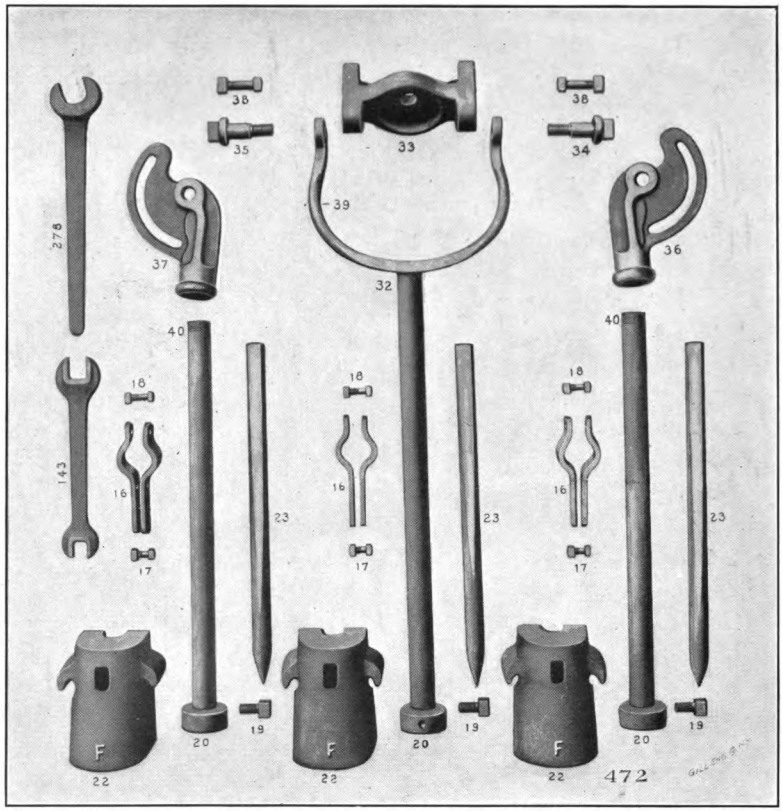
## 3. Quadrant Tripod

We make a heavy special tripod for submarine drills working on vertical holes from docks, floats or platforms, and for the large "Eclipse" drills working on railway cuts, drilling down holes.

This is known as the Quadrant Tripod, so named from the method of adjustment. It is an exceptionally solid type, without being unnecessarily heavy, and forms a rigid mounting for the heaviest drills, made for deep holes of large diameters, where the longest steels frequently weigh over 200 pounds. The value of the quadrant adjustment is that the drill need not be tipped or moved in changing steels, the quadrant dropping the machine back far enough to clear the steel with safety and ease. It is described in the accompanying table, page 82, and also in the drill tables under G and H drills.

# QUADRANT TRIPOD for G and H Ingersoll Rock Drills

DUPLICATE PART LIST




| Number and Name of Part | | Number and Name of Part | |
|---|---|---|---|
| 16 Weight Hanger | | 35 Side Hip Bolt—Right Hand Side of Tripod | Looking from the back of Tripod |
| 17 Weight Hanger Short Bolts | | 36 Side Hip—Left Hand Side of Tripod | |
| 18 Weight Hanger Long Bolts | | 37 Side Hip—Right Hand Side of Tripod | |
| 19 Pointer Set Screw | | 38 Quadrant Clamp Bolt, Washer and Nut | |
| 20 Set Screw Bands | | 39 Back Leg Yoke | |
| 21 Front Leg Pointer | | 40 Front Leg Pipe | |
| 22 Weight | | 143 Wrench | |
| 23 Back Leg Pointer | | 278 Wrench | |
| 32 Back Leg Pipe | | | |
| 33 Saddle | | | |
| 34 Side Hip Bolt—Left Hand Side of Tripod | Looking from the back of Tripod | | |

NOTE.—When ordering parts always give the SIZE and SYMBOL of DRILL for which the tripod is used, also number and name of the parts as per above list.

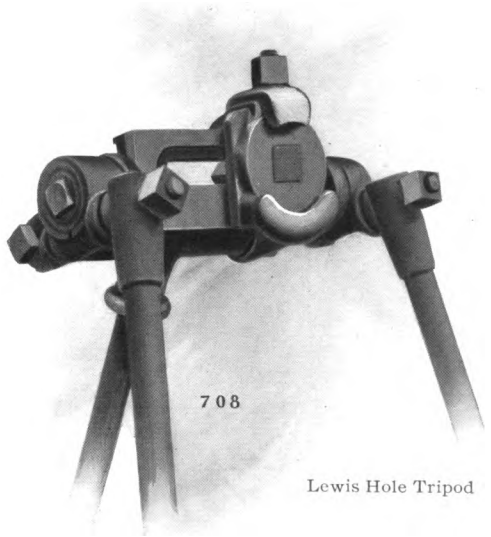
## Lewis Hole Tripod

In quarrying work it is desirable to drill a number of parallel holes close together. Sometimes the amount of this work does not warrant the purchase of a quarry bar or channeling machine, and the frequent moving which would result were an ordinary drill and tripod used, makes some other arrangement desirable. For this purpose we furnish a special tripod, known as the Lewis Hole Tripod. It resembles in all respects the Standard Ingersoll-Sergeant Universal Joint Tripod, except for the saddle.

For this is substituted a plate with a slot, through which passes the usual clamp bolt used to lock the clamp in any desired position on the slide.

This arrangement permits a 6-inch lateral movement of the drill in the small sizes and a 9-inch in the larger, which means three holes 3 inches apart, center to center, after which a broaching bit is used to break down the wall between the holes.

The clamp is made to fit either the Standard, Ingersoll or Sergeant Shell Cone, and any B, C, D, E or F drills can be used on this tripod.




Lewis Hole Tripod

# Standard Tripods for Mounting Rock Drills

| Type | Size Letter | Used for | Net Weight, pounds | | | Price complete | Telegraph Name | |
|---|---|---|---|---|---|---|---|---|
| | | | Tripod | Weights | Tripod complete with Weights | | With Sergeant Saddle | With Ingersoll Saddle |
| Sergeant | A 35 | All A Drills except A 24's | 80 | 120 | 200 | $30.00 | Sergea | Seringea |
| Sergeant | D 24 | B's, C's, D's | 160 | 285 | 445 | 50.00 | Serked | Serinked |
| Sergeant | E 24 | E's, F 3, FA | 210 | 330 | 540 | 50.00 | Serlie | Serinlie |
| Sergeant | F 24 | F 9, F 24, F 32 | 275 | 375 | 650 | 55.00 | Sermof | Serinmof |
| Ingersoll* | 2 in. | Baby, 32 | 60 | 120 | 180 | 30.00 | Inserola | Insola |
| Ingersoll* | 3 in. | B's, C's and D | 150 | 285 | 435 | 50.00 | Inserdad | Indad |
| Ingersoll* | 3½ in. | E's and F | 160 | 330 | 490 | 55.00 | Insergef | Ingef |
| Quadrant | H | G's, H's | 325 | 375 | 700 | 65.00 | ..... | Quadra |
| Lewis Hole | E 25 | C's, D's, E's, F's, FA | 270 | 330 | 600 | 60.00 | Lewie | Lewinie |
| Lewis Hole | F 25 | F 9, F 24, F 32 | 330 | 375 | 705 | 65.00 | Lewaf | Lewinaf |

**Note**—The SERGEANT SADDLE is standard and is the form sent with ALL SERGEANT TRIPODS UNLESS OTHERWISE SPECIFIED. Sergeant Tripods are always supplied with saddle to mount the type of drill furnished.

QUADRANT—Furnished with G and H Drills. Has Ingersoll cone.

*INGERSOLL—Old style tripod without side adjustment is furnished only when specially ordered. Customer should specify "Ingersoll" or "Sergeant" cone.

## STANDARD TRIPOD "WEIGHTS"

| | | | | | |
|---|---|---|---|---|---|
| Size A = 40 pounds.. | Price, each, $1.50 | used for A size tripod | Size BC = 125 pounds | Price, each, $4.00 | used for F and Quadrant sizes tripod |
| Size C = 90 pounds.. | " " 3.00 | used for A size tripod | Size E = 95 pounds | " " 3.25 | used for E 25 size tripod |
| Size E = 95 pounds.. | " " 3.25 | used for D size tripod | Size F = 110 pounds | " " 3.50 | used for F 25 size tripod |
| Size F = 110 pounds.. | " " 3.50 | used for E size tripod | Size BC = 125 pounds | " " 4.00 | used for bar channelers |

## Broaching Attachment

If it is intended to do broaching the drill is fitted with a special release rotation which allows the drill to operate without rotating when breaking down the web between the holes. This is thrown in or out of action by turning a thumb screw. A slight extra charge is made for this attachment.

When first ordering a drill, or if this device is desired on an old drill, it is necessary to supply a number of extra parts.

*In ordering* the Lewis Hole Tripod (E 25 or F 25 type) to fit a drill you now have, state whether a 6-inch or 9-inch slide is wanted, and the drill size letter and type of drill, whether Sergeant Auxiliary Valve, New Ingersoll or Arc Tappet, B, C, D, E or F. Also the kind of shell, whether fitted with Ingersoll or Sergeant cone. If ordering a tripod and drill complete, state cylinder diameter and type of drill, and whether the release rotation is wanted.

Adjustability. Working Close to the Ground


Gold Mining Scene, South Africa. Showing Drills on Short Columns Following Vein

Single Screw Column or Shaft Bar with Clamp, and Sergeant "Auxiliary Valve" Drill

## Double Screw Columns
## Single Screw Columns or Shaft Bars

IN shaft sinking and tunneling work, as in driving headings and enlarging, it has been found that the column is the best means of mounting rock drills. These columns are simply round, extra heavy wrought steel tubes, with a suitable claw-foot or rosette on one end, and either one or two clamping or jack screws at the other. The column is set up and the screw run out, thus jacking the column between the floor and the ceiling or between side and side of the tunnel or shaft.

In shaft sinking or tunnels of small section, such as 6 ft. x 6 ft., single screw columns are generally used on which is mounted one drill by means of a special patent clamp, which permits the drill to be adjusted so as to put in a hole at any height or angle.

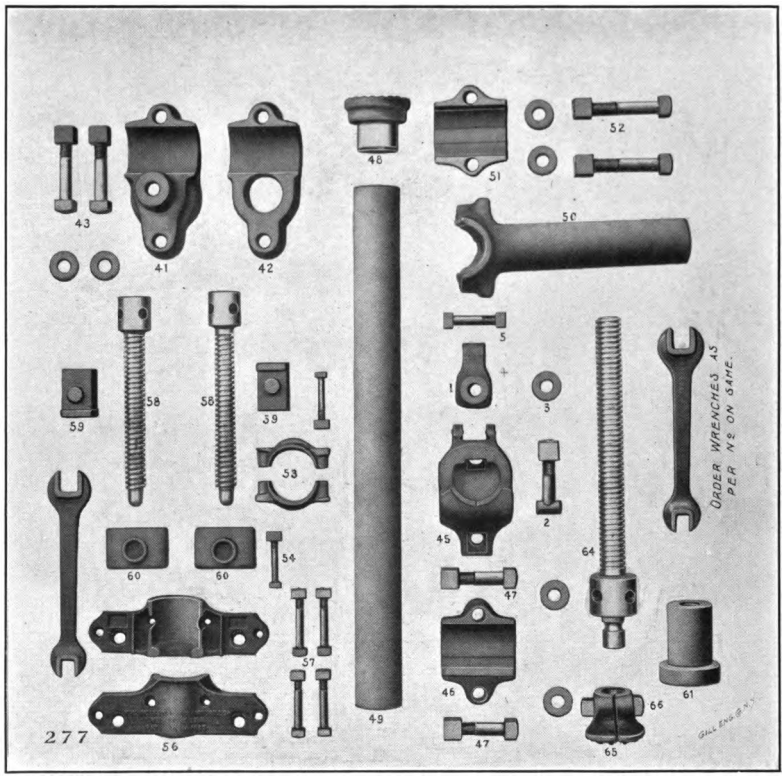
In tunnels of larger section the double screw column is always employed, with one or two swinging arms on which

## Single and Double Screw

# COLUMNS, ARMS AND CLAMPS

### For all Sizes of Ingersoll and Sergeant Drills

DUPLICATE PART LIST




| Number and Name of Part | Number and Name of Part |
|---|---|
| 1 Jaw | 50 Column Arm |
| 2 T Bolt and Nut | 51 Column Arm Cap |
| 3 Washer for T Bolt | 52 Column Arm Bolt |
| 5 Jaw Bolt | 53 Safety Clamp |
| 41 Column Arm Clamp—Cup Half—Ingersoll | 54 Safety Clamp Bolt |
| 42 Column Arm Clamp—Cap Half—Ingersoll | 56 Column Base Block (2 pieces) |
| 43 Column Arm Clamp—Bolt | 57 Base Block Bolt |
| 45 Column Arm Clamp—Cone Half—Sergeant | 58 Jack Screw for Double Screw Column |
| 46 Column Arm Clamp—Cap Half—Sergeant | 59 Jack Screw Nut for No. 58 |
| 47 Column Arm Clamp—Bolt—Sergeant | 60 Jack Screw Cup for No. 58 |
| 48 Column Cap | 61 Jack Screw Nut for Single Screw Column |
| 49 Pipe for Column | 64 Jack Screw for Single Screw Column |
| | 65 Base Block for No. 64 |
| | 66 Base Block Screw for No. 65 |

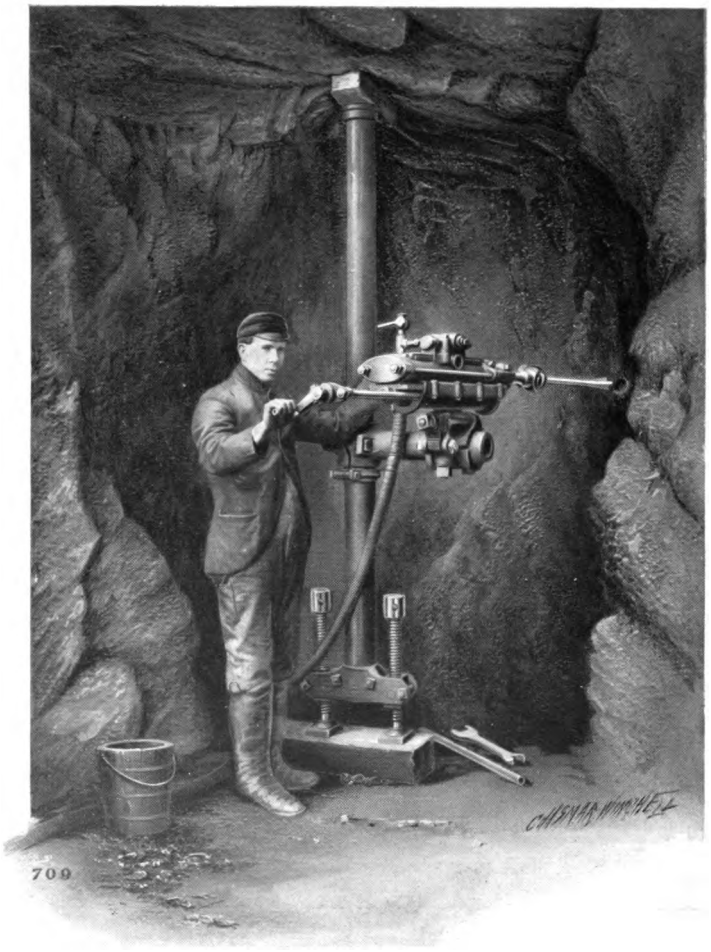
NOTE—When ordering parts give SIZE of COLUMN, whether double or single screw, and SIZE and SYMBOL of DRILL and the name and number of part as per above list.

When ordering columns complete state length wanted CLOSED (*i. e.*, with screw run in short). Allow 8 to 14 inches for blocking.

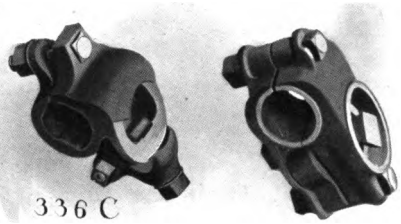
Gold Mining Scene, South Africa. Showing Drills on Columns, Stoping

the drills are mounted. Just below the arm it is customary to place an adjustable "safety clamp." When this is used the arm carrying the drill may be loosened and swung to one side when bits are being changed and swung back without losing the alignment.

In some cases two or more columns are used in the heading at the same time, each carrying two drills. In hard rock and tunnels of fair proportion this proves the best method, and two columns, with extra arms and clamps for four drills, are a satisfactory combination.




Double Screw Column with Arm Clamp, Safety Clamp and Sergeant Drill



Column Clamps, Sergeant-Ingersoll

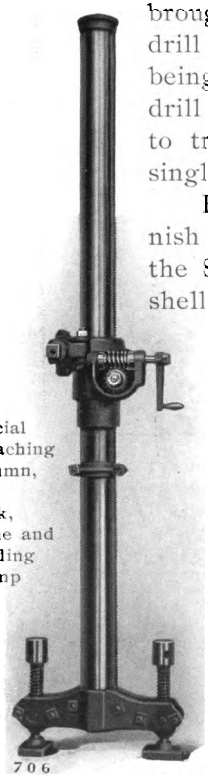
These columns are the lightest and strongest made, as the body is of double heavy wrought steel tube instead of angle irons or castings. The base blocks and other parts liable to break are malleable castings, while the jack screws are of steel carefully ground, and screw in steel blocks which are pivoted in such a manner as to transmit evenly to the column any strain due to irregularity in the flooring.

It must be borne in mind that an arm cannot be used with the single screw column, or shaft bar as it was formerly called, because the leverage turns the bar and works the drill out of line.

In connection with these columns the patent safety column arm clamp we use for holding the machine has many advantages over others.

In this clamp, known as the Sergeant, a swinging jaw is brought to bear upon the reverse cone back of the drill shell by a single bolt, and this admits of the drill being mounted or unmounted easily and quickly. The drill can also be rapidly transferred from column to tripod without change of bolts by slacking off a single bolt.

For mounting Ingersoll drills on columns we furnish the Ingersoll column arm clamp, which resembles the Sergeant, but uses a heavy bolt to secure the drill shell to the clamp.



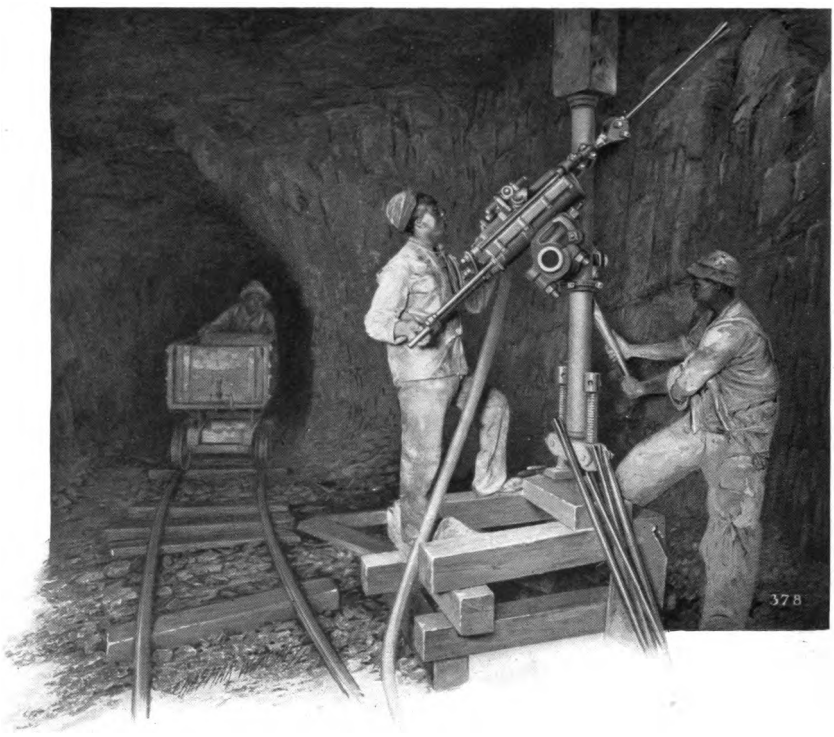
Special Broaching Column, with Rack, Spine and Feeding Clamp

The length of columns should always be stated in orders as "closed," or with screws clear in. The screws have a feed of 6 to 13 inches, and allowance should be made for 8 to 12 inches of wooden blocking altogether, as without blocking they will not hold. In use the screws should be worked short, using blocking so far as possible, as this gives greater stiffness without liability to work out of alignment.

Shafts up to 8 feet in width, unless in very hard rock, should not use more than one drill on a single screw column. We have furnished these in especially long lengths, but in large shafts the tripod is preferred.

We also make special long bars for tunnels of large section and combinations of columns, quarry bars and drills, to meet special conditions for underground quarries, sewer trenches and other work.

If single screw column is wanted, state whether or not clamp complete is wanted. If double screw, whether or not arm and clamp complete are wanted.




Double Screw Column in Use

# Columns and Shaft Bars—Sizes, Weights and Prices

| TYPE | Outside Diameter Inches | Minimum Length Screws Run in Feet | Suitable for Drills Cylinder Diameter Inches | Weights: Column and Screws Pounds | Weights: Arm and Clamp Pounds | Weights: Total Pounds | Price: Complete without Arm or Clamp | Price: Complete with Arm and Clamp | Telegraph Name Complete Column* |
|---|---|---|---|---|---|---|---|---|---|
| Double Screw Column..... | 3 | 6 | 2, 2¼, 2½ | 95 | 62 | 157 | $33.00 | $55.00 | Tolas |
| Double Screw Column..... | 3 | 8 | 2, 2¼, 2½ | 103 | 62 | 165 | 33.00 | 55 00 | Tolases |
| Double Screw Column..... | 4 | 6 | 2½, 2¾ | 139 | 132 | 271 | 35.00 | 58.00 | Tolero |
| Double Screw Column..... | 4 | 8 | 2½, 2¾ | 162 | 132 | 294 | 35.00 | 58.00 | Toleroses |
| Double Screw Column ..... | 4½ | 6 | 2¾, 3¼ | 185 | 175 | 360 | 36.00 | 60.00 | Tomis |
| Double Screw Column..... | 4½ | 8 | 2¾ to 3¼ | 215 | 175 | 390 | 36.00 | 60.00 | Tomises |
| Double Screw Column..... | 5½ | 6 | 3½ | 270 | 185 | 455 | 50.00 | 80 00 | Tonor |
| Double Screw Column..... | 5½ | 8 | 3½ | 305 | 185 | 490 | 50.00 | 80.00 | Tonores |
| Single Screw Column or Shaft Bars | 3 | 6 | 2, 2¼, 2½ | 70 | 20 | 90 | $33.00 | $45.00 | Onlat |
| Single Screw Column or Shaft Bars | 3 | 8 | 2, 2¼, 2½ | 78 | 20 | 98 | 33.00 | 45 00 | Onlates |
| Single Screw Column or Shaft Bars | 4 | 6 | 2½, 2¾ | 132 | 57 | 189 | 35.00 | 47.50 | Onlene |
| Single Screw Column or Shaft Bars | 4 | 8 | 2½, 2¾ | 147 | 57 | 204 | 35.00 | 47.50 | Onleneses |
| Single Screw Column or Shaft Bars | 4½ | 6 | 2¾ to 3¼ | 175 | 75 | 250 | 37.00 | 50.00 | Onpon |
| Single Screw Column or Shaft Bars | 4½ | 8 | 2¾ to 3¼ | 195 | 75 | 270 | 37.00 | 50.00 | Onpones |
| Single Screw Column or Shaft Bars | 5½ | 6 | 3½ | 220 | 86 | 306 | 50.00 | 67.00 | Onsug |
| Single Screw Column or Shaft Bars | 5½ | 8 | 3½ | 260 | 86 | 346 | 50.00 | 67.00 | Onsuges. |

(Weights: Single Screw Clamp Only. Price: Clamp Only, Arm not included.)

REMARKS— Single Screw Column sometimes called Shaft Bar. Prices of Single Screw Columns complete do not include arm, which is not advised nor sent unless specified.

*Telegraph name means complete as usually shipped, including column, clamp, screw stops and pinch bar for turning screw.

Run Jack Screw, Shaft Bar, 3 in. = 13 in.; 4 in. = 10 in.; 4½ in. = 10 in.; 5½ in. = 10 in. Double Screw Column, 3 in. = 10 in.; 4 in. = 6 in.; 4½ in. = 6 in.; 5½ in. ⅛ 10 in. Longer or shorter Columns and Shaft Bars will be furnished when ordered.

# Column Arms, Clamps and Safety Straps

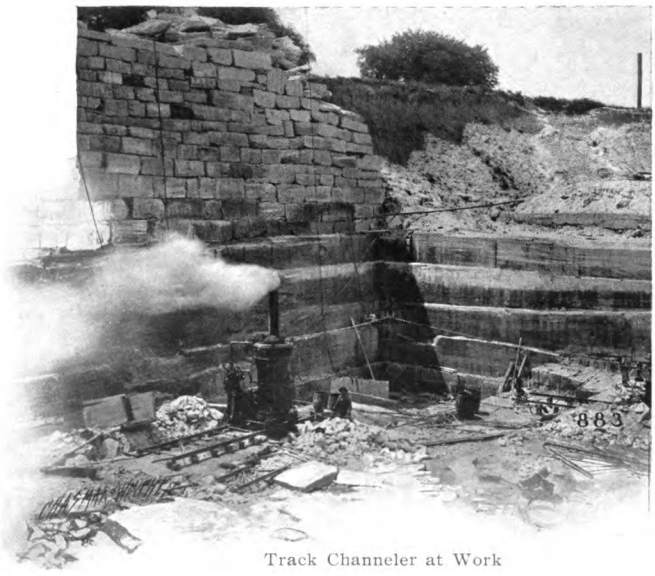
| Outside Diameter of Column Inches | ARMS: Net Weights* Pounds | ARMS: Price | ARMS: Telegraph Name | CLAMPS: Net Weights* Pounds | CLAMPS: Price | CLAMPS: Telegraph Name | SAFETY STRAPS: Net Weights* Pounds | SAFETY STRAPS: Price | SAFETY STRAPS: Telegraph Name |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 30 | $10.00 | Aro | 20 | $12.00 | Clu | 6 | $1.65 | Saf |
| 4 | 74 | 10.50 | Arod | 57 | 12.50 | Clud | 7 | 1.75 | Safo |
| 4½ | 74 | 11.00 | Arodu | 75 | 13.00 | Cludu | 8 | 1.90 | Safodu |
| 5½ | 90 | 13.00 | Arodus | 86 | 17.00 | Cludus | 10 | 2.20 | Safodus |

For shipping weights add: Domestic, 2 per cent; Export, 5 per cent.

# Modern Quarry Methods

A GENERAL review of quarrying, past and present, carries the conviction that this industry has not kept pace with modern tendency and progress towards cheaper production. In building operations revolutionary changes have come about in the last few years in the erection of steel buildings and the manufacture of terra cotta and clay products, while quarrying has been, generally speaking, stationary.

The natural result of this has been a large increase in the use of those materials for general bridge and building work, where the natural preference would have been for stone as an ideal and more permanent material but for its prohibitive cost. As the rapid increase in the use of these other building materials is the direct result of the use of modern methods and machinery to the elimination of hand labor in the greatest degree, it follows that in this direction also lies the continued prosperity of the stone business.



Track Channeler at Work

This view is confirmed by an examination of general manufacturing methods in other lines where directors and managers are not only ready to adopt the best methods, but are actively and constantly in search of means to lessen the cost of production or increase its amount in a given time.

## Waste of Natural Resources

There has been a tendency with every natural resource towards extravagant and wasteful methods, and it is only recently that the production of iron, other ores, coal and timber has begun to receive proper attention in the way of economy. In coal, for instance, with older methods 30 to 60 per cent. of the coal was a permanent loss, while the best modern mining seldom leaves more than 2 to 5 per cent. in the vein. A business man, with an interest in a manufacturing establishment and also in a mine or quarry, will be sure to insist on the best methods in his factory without perhaps realizing that he has even less reason for neglecting these necessary features in obtaining his raw material, since the material forms perhaps the largest percentage in the cost of most bridges, building and engineering structures.


Bar Channeler at Work

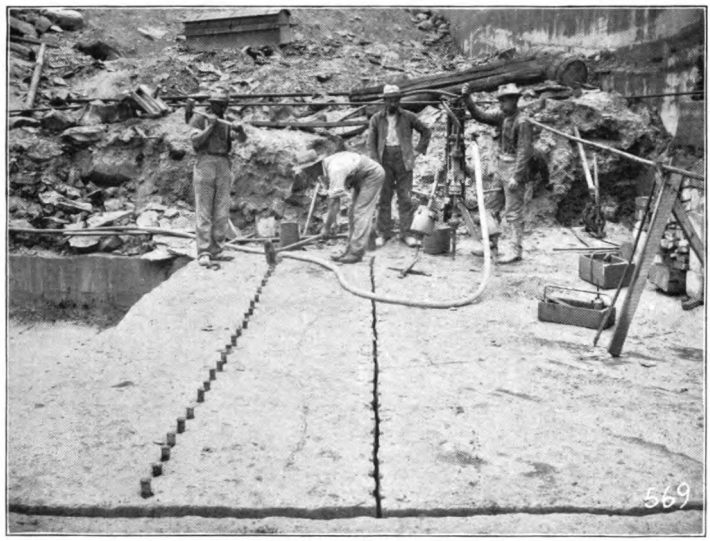
Appearance of Stone as Usually Quarried

An able writer recently condensed the whole drift of modern manufacturing in a very pertinent statement, showing the methods which have led up to the most important commercial success known to history, that of the Carnegie interests. He said that Carnegie never hesitated to discard any system of machinery, no matter how new and without regard to its cost, as soon as a better way was found

to accomplish the same end, and that where in a typical plant 800 men were formerly required to produce 1,200 tons of steel, this policy has resulted in the present situation where 65 men through the aid of machinery now produce 1,500 tons in the same time. It is a matter of record that this has been accomplished by scrapping plants which foreign manufacturers would have considered good for three generations to come, but the result speaks for itself.

## Better Machinery for Quarrying

There is nothing saved in trying to wear out inefficient machinery, built on designs which originated perhaps a gen-

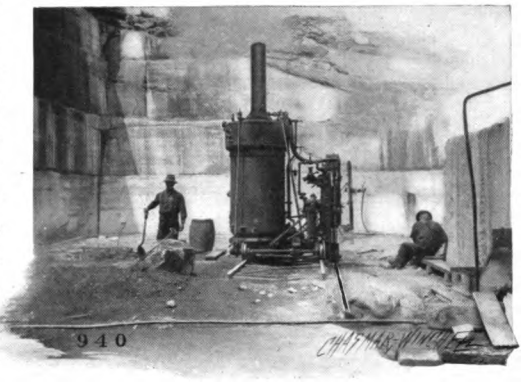



Splitting Stone with Plymouth Wedge

eration ago, because very little quarrying machinery is worn out, being simply repaired and renewed in part to the extent of keeping it in chronic operation, with more than all its original disadvantages in high cost of its work, through its capacity being reduced by wear and leakage, since repairs are made to replace broken parts. This failing, however, to restore the machine to even its original "out-of-date" condition.

The argument has been presented in all sincerity that mechanical methods cannot be used to the same advantage in

quarrying rock as in the case of general manufacturing. To some extent this is true, depending upon the class of quarrying; for instance, in some quarries producing rough rubble without regard to size or dimensions, the mechanical features are confined to drilling, electrical blasting and suitable hoisting apparatus and perhaps pumping or crushing, with the occasional use of steam shovels. There can be no question as to the economy of machine drilling over hand drilling, and this point has already been brought out in another part of this catalogue, page 24.



Ingersoll-Sergeant Track Channeler

## The Harder the Material the Greater Saving with Drills

In a general way experience has established the fact that the harder the material and the more difficult to drill by hand, the greater is the advantage of machine drilling, and further that the conditions are extraordinary where each rock drill with its crew will not do an amount of drilling equivalent to the labor of at least eight men, and the saving ranges on up to the displacement of twenty men in the slower drilling materials.

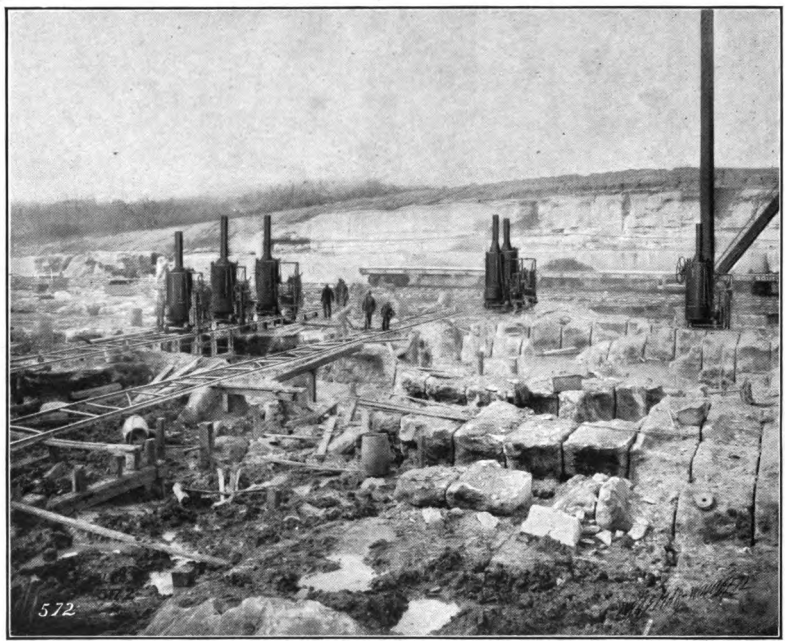
With more particular reference to that class of quarries producing stone of marketable and regular dimensions, a point of importance is that the more extensively machine methods are adopted the greater the reduction of the cost of production, and the more elastic is the capacity of the quarry as to filling large orders on sudden demand, because the tonnage produced per man is so much greater than in exclusively hand-operated quarries.

## Successful Quarries

Successful quarries are those which closely approach the ideal of eliminating hand labor and, as in other profitable operations, are the result of heavy investments in all the

machinery which can be used up to that point where additional apparatus will not reduce the waste. The modern methods of channeling, plug and feather work, power wedge hole cutters and the use of compressed air, very nearly reach this point as it calls for few machine operators, a few men to bar out the stone so loosened, and a gang of derrick men to place it on the cars for shipment in that attractive form best calculated to hold and expand the market at the highest trade price for the product.

In most quarries (frequently located in out-of-the-way




Channeling Scene. Opening Up the Quarry. Indiana Oölitic District

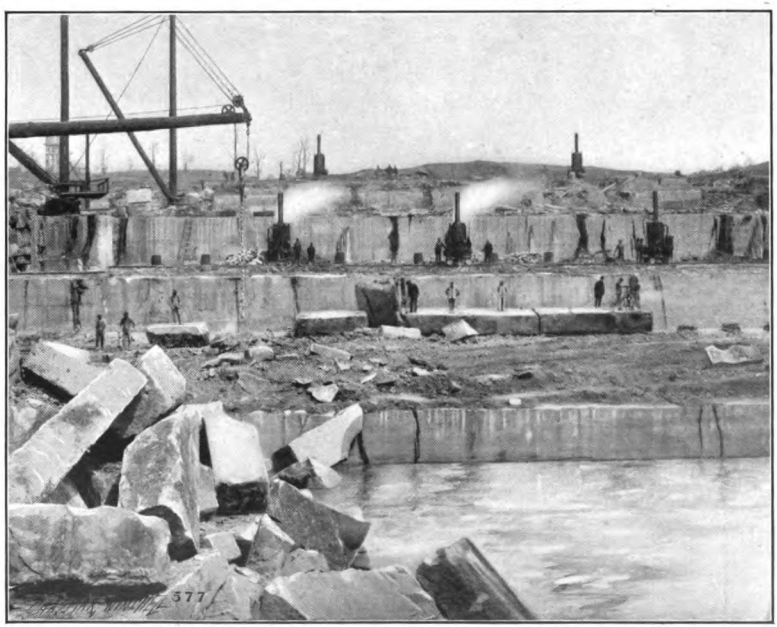
places, where good labor is scarce), the operating period is limited by the comparative shortness of the working season, and therein lies another advantage of machinery. Again, the smaller the force, the more easily it is controlled and the better the opportunity for sifting the men down to a picked gang of machine runners, men who, at a slight addition over the prevailing rate of wages, will not only do very much more work, but will come nearer to the production of a perfect output without wasteage.

## Pioneer in this Field.

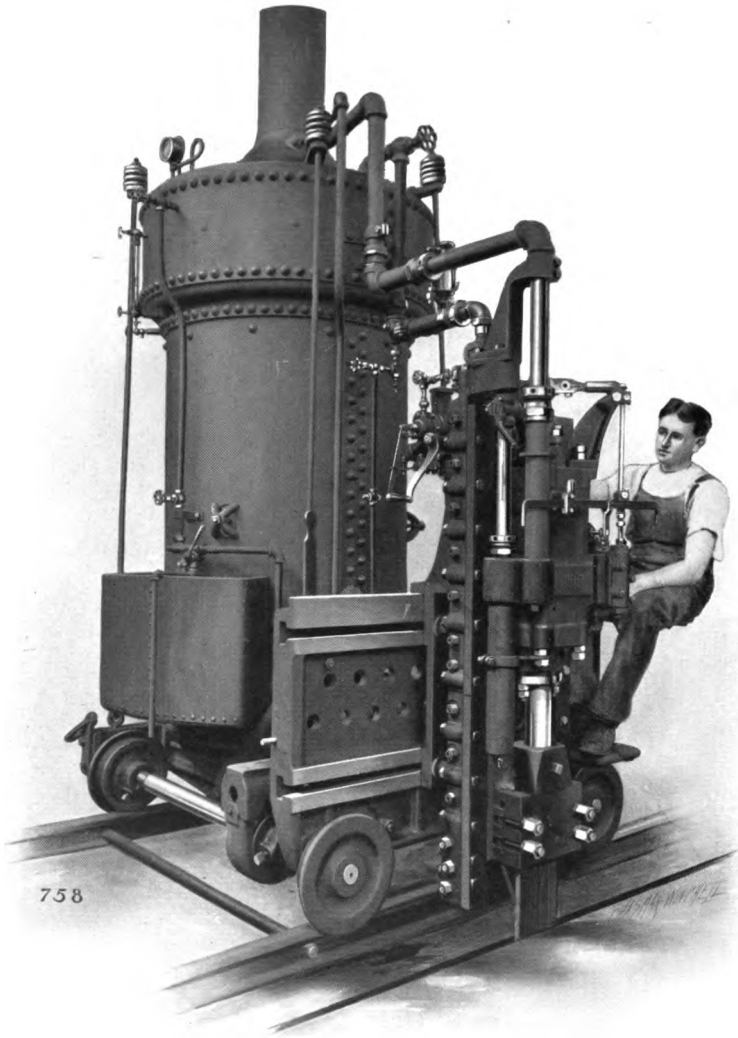
As the pioneer manufacturer we have developed the Channeling Machine, the Gadder, Rock Drill, Air Compressors and machinery for cutting wedge holes to a point not possible to other makers recently entering the field, and on the following pages we present a line of important labor-saving apparatus which can be accepted with confidence as the result of the longest and broadest experience, as the survival of the fittest.

## Recent Improvements

A study of the following illustrations will show radical departures from our earlier constructions, many features being completely re-designed; no pains have been spared to introduce every convenience of operation or any change which would add in the least to the capacity or durability and make these modern forms applicable to cases where formerly such machines could not be satisfactorily used.



Quarrying with Ingersoll-Sergeant Track Channelers, Indiana Oölitic District




Ingersoll-Sergeant Track Channeler with Boiler

# Ingersoll-Sergeant Track Channelers

**Not desiring to hold this catalogue from the press any longer, we are purposely omitting all detailed description of Ingersoll-Sergeant Track Channelers.**

IMPORTANT and far-reaching improvements have been made, and these and also older standard machines will be fully described in a special channeling machine catalogue now in course of preparation.

Until the appearance of this complete treatise on machine quarrying, we will be glad to take up with customers, by means of circulars, special correspondence and personal interviews, their requirements for channeling machines, furnishing full details of a new line of powerful channelers which we are now about to introduce. These new machines are the result of a greater experience with this class of machinery than that of any other one concern, all of which has placed us in a very advanced position in this most important branch of the quarrying industry, and enables us to meet any condition with a success beyond that attained by any of our earlier models, or beyond that possible with any other type of machine.

## Track Channelers

To meet the varying requirements of different classes of work we make four styles of channelers. These are suitable for working in marble, sandstone, slate or other quarries for getting out dimensioned stone, and are also used in special contracting work where a considerable area of rock facing must be done at the lowest possible cost.

## Capacity

In tests over 700 square feet have been channeled, and many instances can be cited where 250, 300 and 450 square feet were cut in ten hours, at a cost of from 2 to 10 cents per square foot, which is further reduced by a considerable saving of stone which would be wasted were hand methods employed.

Special cuts have been made to a depth of 25 feet and more, although the average is from 8 to 16 feet, and the

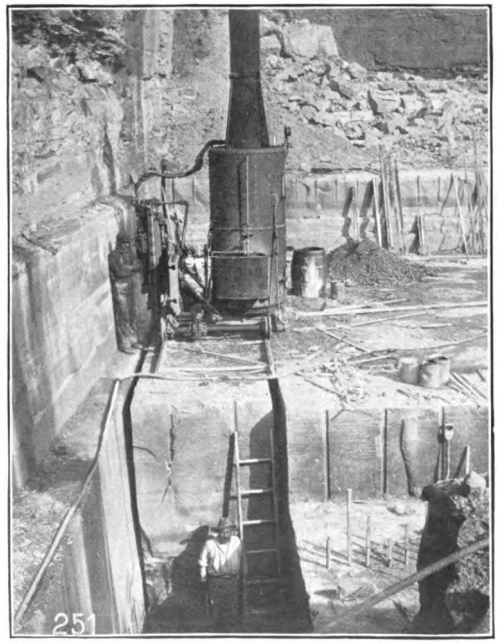
most difficult kind of hard or bad channels are worked easily and with certainty of finishing rapidly and surely.

This machine will do more work with one gang of bits than any double gang machine with two, and will furnish a cut close to a parallel face or full up to either end of the track without turning the machine around.

## Guarantee

We guarantee this recently improved machine to be without an equal for amount of work done, for low cost of repairs, labor and fuel consumed, for durability in difficult kinds of channeling, and for convenience and ease of operation in any kind of rock or on work where a machine of this kind can be used.

No other channeler is so powerful, so simple, of such great strength and massiveness in its parts, without unnecessary weight, so well built throughout or made of such carefully selected materials.

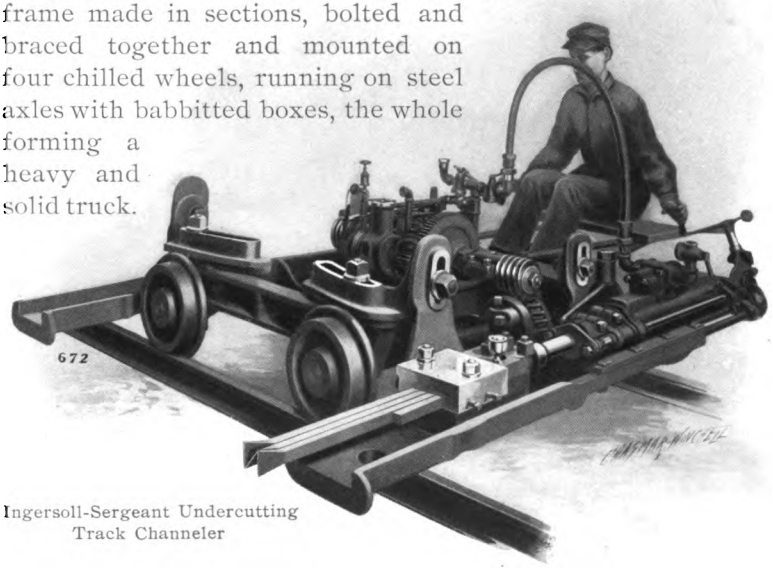



"An Old Timer"—In Constant Use for Over 13 Years—
Channeling a 9 ft. Key Block

# 3⅝-Inch Undercutting Channeler
## (Type H F 2)

IN many marble, slate, sandstone, serpentine and other quarries there are no free horizontal beds, and rifts or cleavage of the stone run in a vertical direction or at a sharp angle. In these and other places where benches cannot be raised it is desirable to cut under a bench or ledge as well as to channel the vertical sides. For this purpose we have furnished a considerable number of special undercutters which will undercut from 5 to 9 feet.

These machines consist of a heavy rectangular cast-iron frame made in sections, bolted and braced together and mounted on four chilled wheels, running on steel axles with babbitted boxes, the whole forming a heavy and solid truck.




Ingersoll-Sergeant Undercutting Track Channeler

A small three-cylinder engine mounted on the truck, is geared to both sets of wheels and automatically feeds the channeler along the track at a speed under perfect control of the operator, much the same as with the vertical cutting track channeler. At either end of the frame are special shells, resembling in a general way those used on the standard 3½-inch bar channeler. These shells are placed horizontally so as to run very close to the floor level, and are rigidly secured to the frame by two sets of adjustable swivel clamps, admitting of the shells being inclined above or below the

horizontal to give a dip to the cut or swing at an angle to the track to permit cutting into jogs or corners, or both adjustments may be made at the same time, in which case an inclined slot or channel may be cut in advance of the machine. The use of two shells and the arrangement of adjusting links is such that the channeler can work in either direction into corners and very close to the bench or quarry floor. This feature is most important in all cases where a pronounced dip is necessary, or where it is wished to undercut and enlarge the quarry floor.

With each machine is furnished one standard F size drill with 3⅝-inch cylinder and a special feed screw crosshead, with beveled gears on feed screw and crank whereby the crank turns in a horizontal plane instead of on the end of the feed screw as was done on the older form of undercutter.

This arrangement admits of the drill working closer to the track and further reduces the height of bench necessary to clear the carriage and shell.

The drill can be shifted from one shell to the other according to the direction of cutting, for which purpose drill, feed-screw, crosshead and crosshead clamp are interchangeable. When a second drill is wanted, so that both drills can be working at the same time, it should be ordered. We do not, however, recommend the use of two drills, as both can seldom be used with good results, and it has been found that in stone, for which the undercutter channeler is best suited, the one drill will be about all one man can handle.

The drill furnished has the usual solid chuck and "U" bolt, with the improved Sergeant release rotation device, and uses the F steels made with an 18-inch feed for the end or starting holes, or for putting in a series of holes for lofting. For holding the channeling steels, which are the same as those used with the bar channeler, to cut the channel between the end holes or from the end of the last cut to the new end hole, a special crosshead clamp is provided, which has a dowel pin fitting in the drill chuck, the same as is used on the 3½-inch bar channeler.

The three-cylinder traveling engine is geared to the axle through spur and worm gears. The engine is started, stopped or reversed, and made to move the channeler fast or slow by means of a single lever placed within easy reach of the operator.

For convenience a flat seat is provided, so placed that the operator can handle feed crank, engine lever, air or steam supply and lubricators without changing his position.

## Dimensions

Length over all, 8 feet 2 inches.
Width over all, 6 feet.
Gauge of track, 4 feet ⅜ inch inside.
Height from top of rail to top of machine, 2 feet 6 inches.
Distance from bottom of rail to cut when undercutting horizontally, *i. e.*, height of bench left in cutting, 8½ inches.
Total weight for domestic shipment, 6,800 pounds.
Total weight for foreign shipment, 7,500 pounds.

## Outfit and Equipment

The standard outfit sent on order for a complete machine includes:
One truck complete, with three-cylinder engine, worm shaft, gear and clamps and hinge pieces.
One right-hand shell bare with standards, necessary connecting pieces.
One left-hand shell complete with standards and connecting pieces, feed screw and beveled gear crank.
One F 3⅜-inch steam drill, 1¼-inch shank, "15" style front head fitted with Sergeant rotation and pawl-releasing attachment.
Two right-hand crosshead clamps.
Two left-hand crosshead clamps.
Four clamp keys.
One operator's seat.
One set of F drill steels for end holes, to a length of 7 feet 6 inches over all; in runs of 18 inches.
One set, 2 gangs, 3 steels to a gang, of 1 x 1-inch channeler steels, starting with 1 foot 6 inches to a length of 7 feet 6 inches over all, in runs of 12 inches suitable to channel, to a depth of 7 feet.
Two 12-foot sections of track.
One 6-foot section of track.
One 50-foot length of 1-inch 5-ply marline-wound steam hose with couplings.
Eight fish plates.
Sixteen fishplate bolts and nuts.
One set steel wrenches.
One drill throttle. One No. 8 lubricator. One brass oil cup. One piece packing. One exhaust pipe. One metallic hose connecting engine. Two plug cocks and piping. One part sheet.

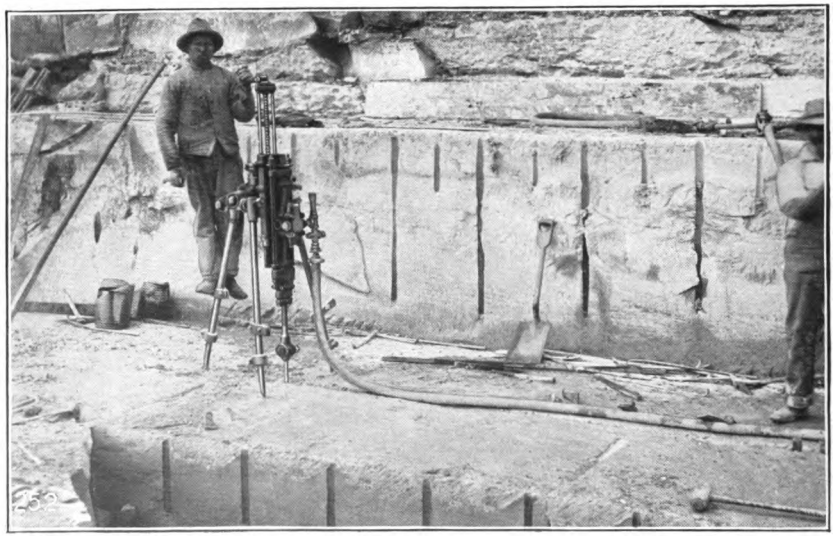
## Details and Duplicate Parts

For duplicate parts of undercutter refer to Form 287.
For duplicate parts of F drill refer to Form 180.
For duplicate parts of three-cylinder engine refer to Form 191.
List price f. o. b. cars Easton, Pa., $1,800
Telegraph name complete undercutter, including equipments as stated, PACKRIEMEN.

# Plug and Feather Work

IN quarries where good breaks require that the splitting strain be exerted well down in the ledge, experience has shown that the best method for getting out the material is usually the Plug and Feather system, in which a series of holes from 1¼ to 2 inches in diameter and of a depth from ⅔ to the full thickness of the sheet are drilled at intervals depending upon the character of the stone and its manner of cleavage. Long metal wedges or plugs are then driven into these holes and the material split away in fairly regular blocks which must otherwise be cut to size by hand.

If we figure on spacing these holes from 4 to 16 inches apart and allow for an average depth of from 8 to 10 inches, it would seem that in the course of a day (if our output is large), we would have moved the drill many hundreds of times. In soft material such as sandstone, a drill mounted on the usual tripod finds frequent use, and this is far superior to hand methods, still in certain classes of work a drill mounted on quarry bar will do much more and better work.

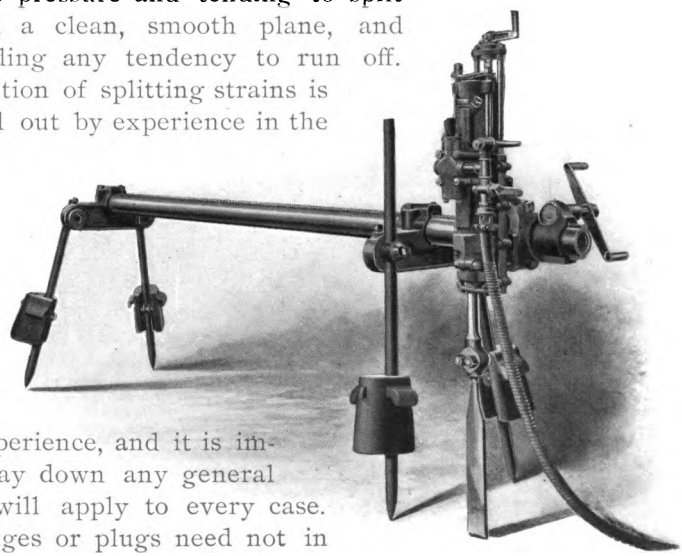


Good Plug and Feather Work, Hard Ohio Sandstone

## Advantages of the Quarry Bar

The advantages of the quarry bar are that all the holes drilled at one setting are plumb, or at the same angle, and parallel at top and bottom, besides being more quickly put in. When the surface is rough the tripod requires adjustment for every hole, and may not be plumbed by a careless runner, deep holes varying badly in bottom alignment, while one set of a quarry bar covers 6 to 10 feet of line, and all holes alike making better breaks and attractive true blocks. Sometimes alternate holes are drilled to double length, intermediate ones being shallow. The lower half of the deep holes is drilled with a smaller drill bit so as to alternate the plug strain top and bottom and control the break by skillful sledging.

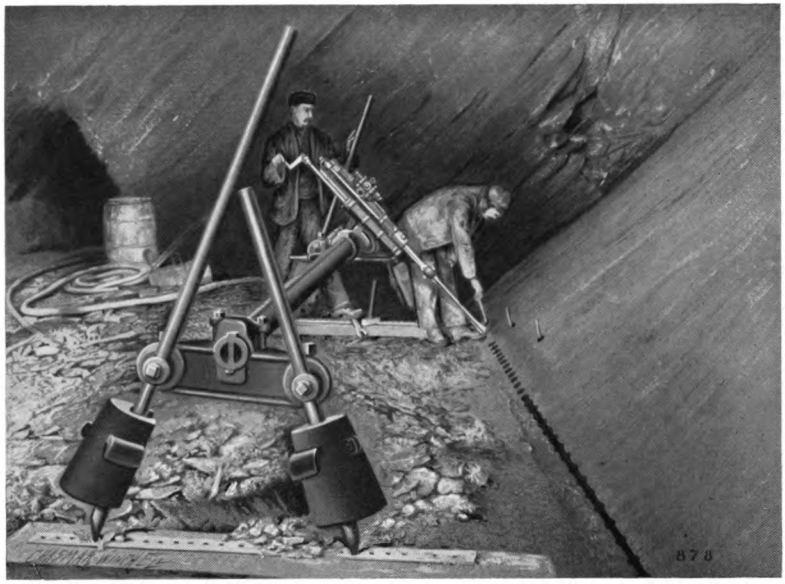
The wedges of the short hole tend to split along the top and those of the long hole split along the bottom, thus distributing the pressure and tending to split the stone in a clean, smooth plane, and largely avoiding any tendency to run off. This distribution of splitting strains is to be worked out by experience in the peculiarities of the different ledges. The number of holes and spacing must also be determined by experience, and it is impossible to lay down any general rule which will apply to every case.



Improved Ingersoll-Sergeant Quarry Bar Showing Drill Beyond Legs for Close Working. Broaching Bit in Place

The wedges or plugs need not in all cases be of a length equal to the depth of the holes. In some marble quarries, plug holes only 5/8 inch in diameter are put clear through the blocks, sometimes 10 feet deep, to weaken the line and insure a straight break, the plugs, however, being shorter.

In starting a line of holes where every other one is deep, the line should begin at the face and end at the back



Bar Channeler in Slate Quarry, Broaching

with a deep hole, to insure carrying the face down true. Holes are sometimes drilled through 4 to 20 of the thinner sheets of rock, all being broken at one operation.

Granite and some limestones break remarkably well with plugs and feathers, and in some cases holes not larger than ⅝ x 5 inches will break even to a depth of 6 feet, leaving the face as true as if it had been cut with a machine. Either the "Baby" Drill (A 32) or the "Light Mining" Drill (A 35), the former where wet steam must be used, are good sizes for this work, and will put in several hundred of such holes in a day. When mounted on a quarry bar one man frequently does more work in a day than 15 or 20 men with hand drills.

## Broaching

In granite and other hard stones holes must be placed closer together and, as a rule, splitting across the grain is abandoned in favor of *broaching*. In this system, a series of holes is drilled, usually about 3 inches apart from center to center, depending upon the hardness of the rock, and a flat bit or "broach" is substituted for the regular steel. This has a face about ¾ x 3 inches, and is forged with a blunt end to crush this thin wall or web between the holes. Drills

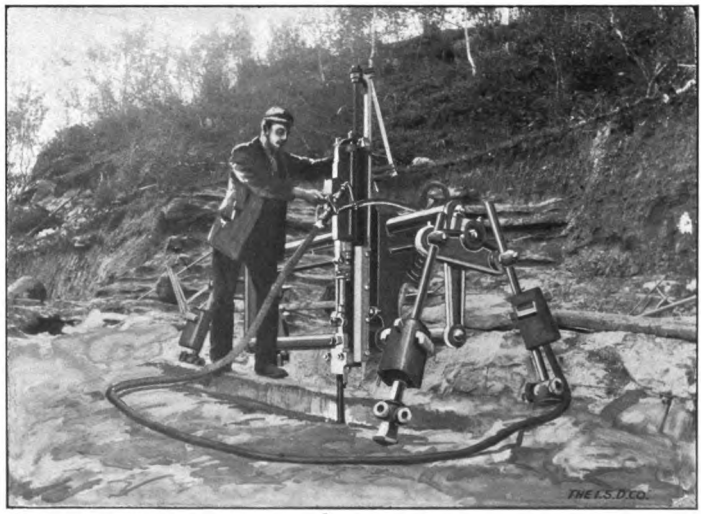
used for broaching must have the release rotation, which is a simple device to throw the pawls out of action and allow the drill to work without rotating.

Broach channeling is the best and cheapest method of cutting out key blocks, sumps, and making wall cuts, etc., in granite quarries, where the rock is too hard to be cut advantageously with the regular channeling machine. This work requires a strong, rigid bar, in perfect alignment, and a powerful drill.

The Ingersoll-Sergeant Quarry Bar will do all kinds of broaching work. If the cut is to be finished up to the edge of the bench, close to the corner or wall, it is not necessary to put the drill on a tripod, as the end piece may be slipped in and the drill transferred to the end of the bar. This avoids delay and crooked channels.

However, for small quarries, where a great amount of channeling is not required and for anything softer than granite, we recommend the bar channeler in preference to broach channeling.

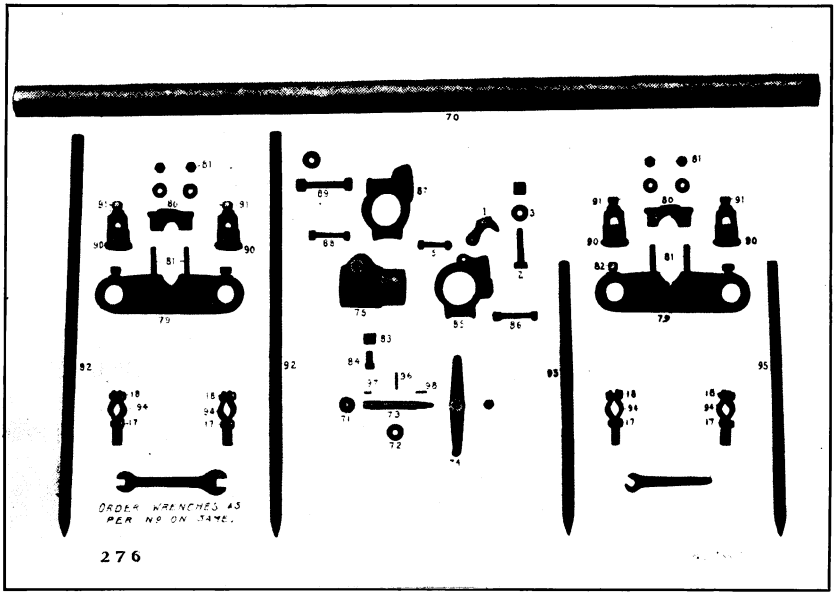
Average work, broach channeling, in granite, 10 to 20 square feet per day.
Average work, broach channeling, in marble, 20 to 30 square feet per day.
Average work, broach channeling, in limestone, 15 to 35 square feet per day.
Average work, broach channeling, in sandstone, 20 to 40 square feet per day.




Standard Ingersoll-Sergeant Bar Channeler with Sliding Cross-head Guide

# QUARRY BAR, 3 in. and 4½ in.

DUPLICATE PART LIST




| Number and Name of Part | | Number and Name of Part | |
|---|---|---|---|
| 1 | Jaw | 82 | End Piece Set Screw |
| 2 | T Bolt and Nut | 83 | Carriage Gib |
| 3 | Washer for T Bolt | 84 | Carriage Gib Set Screw |
| 5 | Jaw Bolt | 85 | Clamp for Sergeant Drills |
| 17 | Weight Hanger Bolt (short) | 86 | Clamp Bolt |
| 18 | Weight Hanger Bolt (long) | 87 | Clamp for Ingersoll Drills |
| 70 | Bar with Rack | 88 | Clamp Bolt |
| 71 | Pinion | 89 | Back Bolt for No. 87 |
| 72 | Collar | 90 | Leg Post |
| 73 | Shaft and Nut | 91 | Post Set Screw |
| 74 | Handle | 92 | Leg (long) |
| 75 | Carriage | 93 | Weight (not shown) |
| 76 | Clamp for "A" Drill (not shown) | 94 | Weight Hanger |
| 77 | Back Bolt for No. 76 (not shown) | 95 | Leg (short) |
| 78 | Clamp Bolt for No. 76 (not shown) | 96 | Collar Pin |
| 79 | End Piece | 97 | Pinion Key |
| 80 | End Piece Cap | 98 | Handle Key |
| 81 | End Piece Stud and Nut | | |

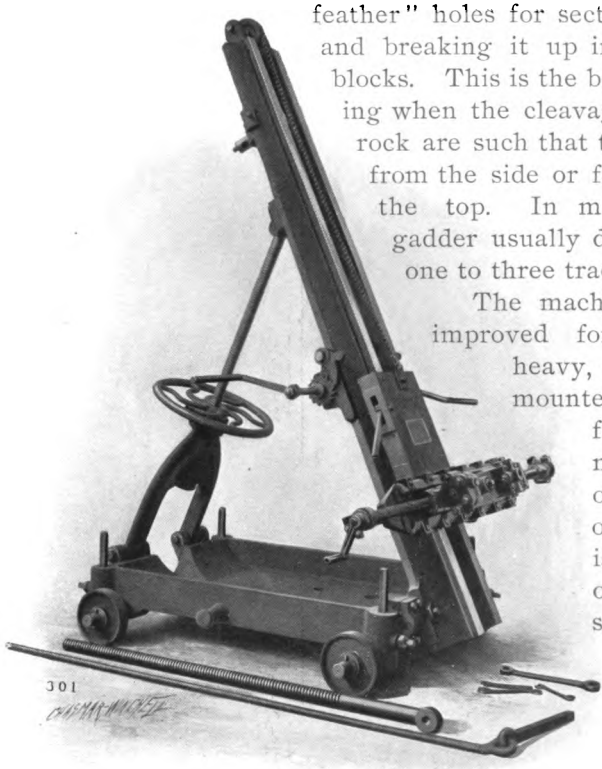
NOTE — When ordering parts, always specify the size of bar and SIZE and SYMBOL of DRILL to be used, and the name and number of part as per above list.

When ordering BAR WITH RACK, specify length wanted.

# Ingersoll-Sergeant Gadder

IN many cases it is desired to drill a series of parallel and closely placed holes in a vertical or inclined line or horizontally, close to the floor of the quarry.

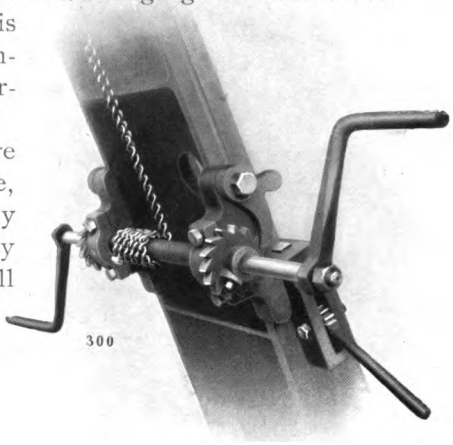
The Ingersoll-Sergeant Gadder was designed for this purpose. It is used in connection with the channeling machine in what is called "lofting" or breaking material from the quarry floor after it has been channeled or split from the material behind. It is also used for putting in "plug and feather" holes for sectionalizing the stock and breaking it up into smaller regular blocks. This is the best method of working when the cleavage properties of the rock are such that the breaks are made from the side or face instead of from the top. In marble quarries one gadder usually does the drilling for one to three track channelers.




Ingersoll-Sergeant Gadder

The machine, in its present improved form, consists of a heavy, solid cast iron body mounted on four wheels, forming a truck, running close to the floor of the quarry. To one end of the truck is hinged a standard or arm which can be swung from nearly horizontal to vertical and firmly locked in any desired position. For this purpose a long inclined screw is provided at the back and the adjustment is effected by simply turning a suitable hand wheel running on the screw. On the swinging arm or standard is a "saddle" or sliding carriage on which may be mounted by means of a cone pivot and bolt any one of several sizes of rock drills, according to the

work to be done. To raise or lower the drill and move it along the slide a chain is attached to the saddle and run up and over a sheave at the end of the swinging arm and down to a small drum on which it is wound by turning a crank conveniently placed for the operator.



Gadder Saddle; Chain Shaft and Ratchet

A special taper gib or wedge clamp is fitted on the saddle, wherewith the saddle is firmly locked to the swinging arm by simply throwing down a small lever when the drill has been raised or lowered to the proper position. At each corner of the truck frame is a large pointed steel pin or pointer slipping freely in a guide socket, and when the machine is properly lined a blow from a sledge on each of these pins anchors the truck in place, prevents any side or end movement and permits the drilling of the series of holes parallel and in absolute alignment without further attention.

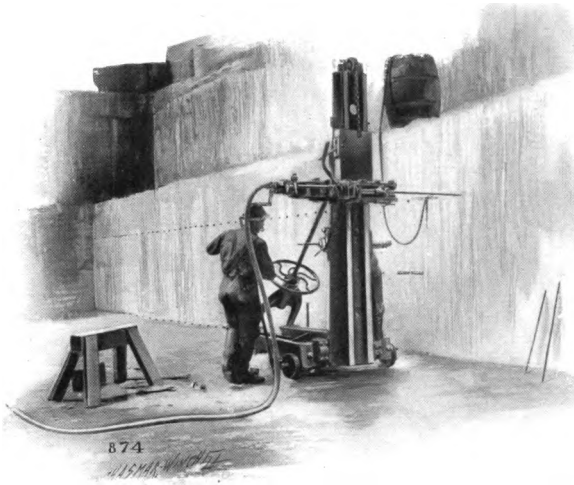
When the bench is six feet or more in height, it is best to use a "tie rod" or brace while putting in the top holes. One end of this rod is hooked to the upper part of the standard and the link on the other end is driven into a hole or the channel which may have been cut beyond the bench.

With this gadder holes may be put in close to the bottom of the quarry in a horizontal position, along the bench, into the roof if quarrying underground, or perpendicularly into the floor as desired. These positions are obtained by swinging the standard, sliding the saddle, or by turning the drill on its pivot, which adjustments admit of a universal movement.

In drilling deep holes, or where it is necessary to use water, a barrel is placed on a convenient bench and the water siphoned down and squirted into the hole through a small pipe which is attached to the saddle.

This machine has broken all records in lineal feet of hole drilled in a working day, and there are instances where 350 feet and over have been drilled in ten hours. On account of the rapidity with which the drill can be moved from a

finished hole into position for the next, the standard sizes of gadder drill will average considerably more than the same drill mounted on a tripod and working in the same material.




Gadder at Work in Marble Quarry

The capacity of the machine is also increased through the use of a special shell which allows a hole to be put in 3 feet deep without stopping. To change from one bit to the next longer, requires about twenty seconds, the feed screw having a coarse thread for quick return.

**The Equipment Furnished with Each Complete Gadder Includes:**

One truck, with corner pins, standard and long screw, with saddle locking device chain and winding drum.

One "Sergeant" C Drill with a special shell for drilling holes 3 feet deep.

One 50-foot section of 1-inch special marline-wound *steam hose*, with patent couplings.

One 25-foot section of *water hose*, with jet pipe and nozzle.

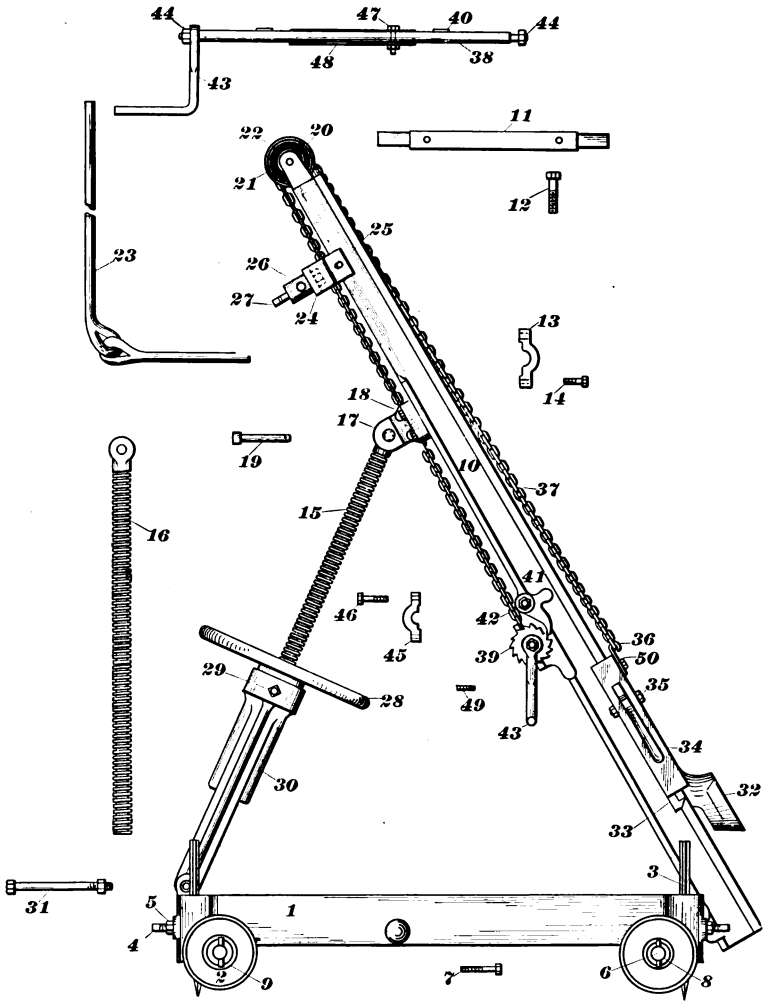
Three drill *steels* (long) with fitted shanks and diamond point bits.

One extra short *back screw* for frame, plug cock throttle oiler and a full set of wrenches.

One tie rod, 8 feet long.

Price complete $465, and price of C, D or E drill and equipment extra. Price, without drill, frame only, $465. Net weight, without drill 3,125 pounds. Shipping weight, without drill, 2,550 pounds. Code Name, frame only, QUADAD. For duplicate parts, number and names refer to page 112.

NOTE: Gadder without drill does not include hose or steels.




NO.899

# Duplicate Part Sheet of Gadder

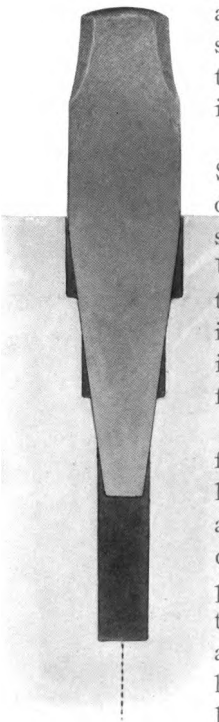
| No. | Pcs. | Name of Part | No. | Pcs. | Name of Part | No. | Pcs. | Name of Part |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Truck | 16 | 1 | St'd Short Screw | 33 | 1 | Saddle Gib |
| 2 | 4 | Truck Wheel | 17 | 1 | St'd Screw Bracket | 34 | 1 | Saddle Lever |
| 3 | 4 | Truck Pointer | 18 | 4 | Screw Bracket Bolt | 35 | 1 | Saddle Lever Bolt |
| 4 | 4 | Pointer Set Screw | 19 | 1 | St'd Screw Pin | 36 | 1 | Saddle Eye for Chain |
| 5 | 4 | Pointer Set Screw Bushing | 20 | 1 | Sheave | 37 | 1 | Chain |
| | | | 21 | 1 | Sheave Shaft | 38 | 1 | Chain Shaft |
| 6 | 2 | Truck Axle | 22 | 1 | Sheave Shaft Pin | 39 | 2 | Chain Shaft Ratchet |
| 7 | 4 | Truck Axle Bolt | 23 | 1 | Guy Rod | 40 | 2 | Ratchet Key |
| 8 | 8 | Truck Axle Washer and Collar | 24 | 1 | Guy Rod Bracket | 41 | 2 | Chain Shaft Pawl |
| | | | 25 | 1 | Bracket Set Screw | 42 | 2 | Pawl Bolt |
| 9 | 4 | Truck Axle Washer Pin | 26 | 1 | Guy Rod Post and Nut | 43 | 2 | Chain Shaft Handle |
| | | | | | | 44 | 2 | Handle Nut |
| 10 | 1 | Standard | 27 | 1 | Guy Rod Set Screw | 45 | 2 | Chain Shaft Cap |
| 11 | 1 | St'd Swing Shaft | 28 | 1 | Hand Wheel | 46 | 4 | Chain Shaft Cap Bolt |
| 12 | 2 | St'd Swing Shaft Bolt | 29 | 2 | Hand Wheel Set Scr. | 47 | 1 | Chain Bolt |
| 13 | 2 | St'd Swing Shaft Cap | 30 | 1 | Yoke | 48 | 1 | Chain Shaft Pipe |
| 14 | 8 | St'd Swing Shaft Cap Bolt | 31 | 2 | Yoke Bolt | 49 | 2 | Ratchet Set Screw |
| | | | 32 | 1 | Saddle | 50 | 1 | Saddle Eye Bolt. |
| 15 | 1 | St'd Long Screw | | | | | | |

For parts of drills, shells, etc., see corresponding sheets, pages 41, 49 and 53.

# The Plymouth Power Wedge Hole Cutter

THIS special application of the rock drill has been perfected by three seasons' experience, and has been found applicable to any stone which will break satisfactory with wedges and in which wedge holes or sheers can be cut by hand picks.

In close-grained sandstone, which is extremely hard and tough, a break with hand-cut wedge hole is almost sure to roll or run off, but 5 to 6 foot sheets have been broken true and square with this new system. No plug work or Knox shooting is done, and the rate of work is very rapid.



Sectional View Wedge Ready to Drive

The apparatus consists of a special Ingersoll-Sergeant Drill of suitable size, with rotation device changed to a straight guide bar and a special short square bit with three cutting edges. Usually holes 1½ inches square at the top and tapering to a substantial wedge shape, 5 to 6 inches deep, are sufficient for ledges up to 24 inches thick, 6 to 8 inches depth, breaking 5½-foot sheets in the quarry shown.

The nature of break is superior to the hand-formed wedge-hole breaks in all cases. The holes are finished complete in one operation, and are not even cleaned out unless stone has been dragged over them. The long, narrow lead gives plenty of driving depth without bottoming. The thin knife edges of the bit groove the hole sharp and deep on each side like a reamed or Knox hole, so the split or fracture leads true from one hole to the next without slivering or ragging.

The steps or offsets of the bit cut the hole wider at the top, so the draw on the wedge is on the point low down in the hole, and as the wedge does not bear at all near the top there is no chipping, spalling or capping on the upper corners. Small wedges are used. As the hole is only about 1½ inch square at the top and ¾ inch on each side of the split, there is not nearly so

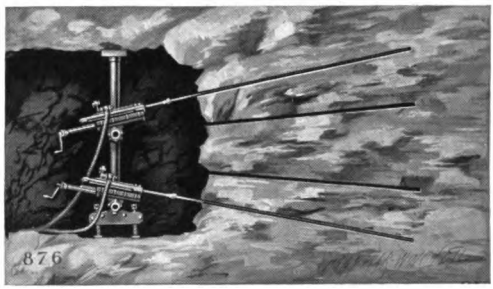
much waste of rock and the surface is that of a natural break, not disfigured with plug or reamed holes, powder stains, etc., which must often be scabbled off in particular classes of work.

The average rate all day long with competent drillers is 30 to 45 holes per hour, though a lively crew with air or dry steam will often run a hole a minute, or 500 to 750 holes a day where the lines are long and level and everything kept out of the way. Each outfit, as a rule, where conditions are suitable, saves 8 to 15 skilled quarrymen and averages 10 men. At the usual wages of $1.75 this is a possible saving of $17.50 per day, or $455 per month, or $3,640 in eight 26-day months, a big profit in itself, especially when several rigs are running. The saving in stone and of scabbling through the better breaks will pay for the outfit alone. Send for Pamphlet No. 43a for details.


12 Feet Long. 5 Feet 6 Inches High. Broken with Plymouth Power Wedge

# Machinery in Shaft Sinking and Opening Mines

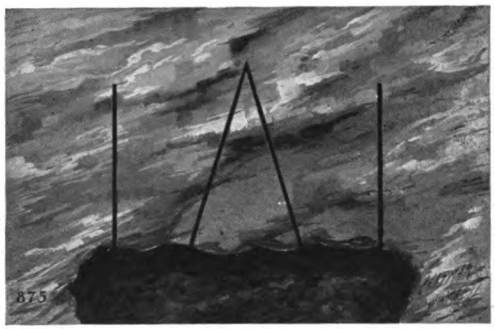
ROCK drilling and air compressing machinery is becoming more generally used, in sinking small shafts, opening small mines, etc., and the objections formerly advanced, as, "We are just starting to sink," "the work is soft," "we do not know just yet what we ought to have," and the like, are now seldom heard.



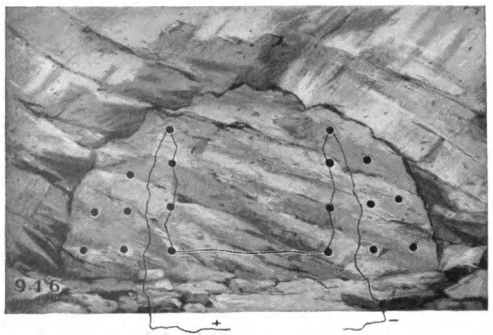

Showing Method of Drilling in Heading

## Cost of Hand Labor

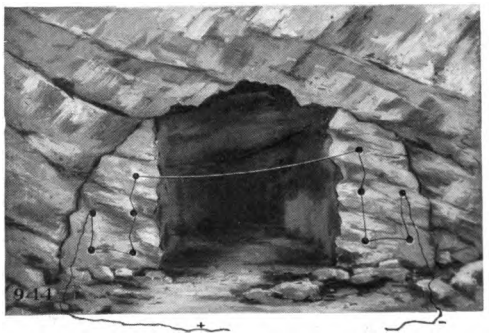
To illustrate the advantage of machinery, we will assume that a mine is to be opened by hand labor. The first step is to sink an 8 x 10 shaft, say 100 feet deep, through such material as is encountered in average mining work. A shaft of this sort would cost about $25 per foot, or $2,500, exclusive of timbering. About four months would be required to get it down by hand. Had a small drilling plant been purchased at the start, costing approximately $1,300 for machinery and comprising a compressor, drill, boiler, receiver, hose, steels, etc., the same shaft would have been sunk in two months, or half the time, with the same number of miners, and the addition of two engineers, making an extra cost of $240 for the two months' work. The other expenses would have been, say eight miners at $50, and two helpers at $25 per month, for two months, and allowing $300 for powder, coal and oil,



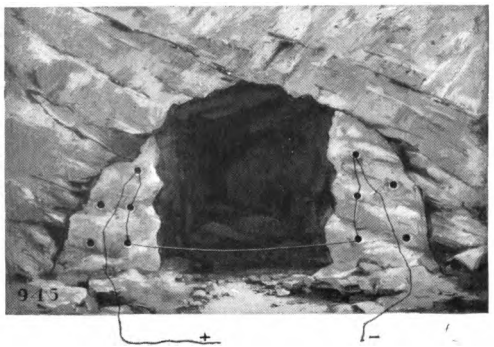

Position of Holes for Key Block and Curtains



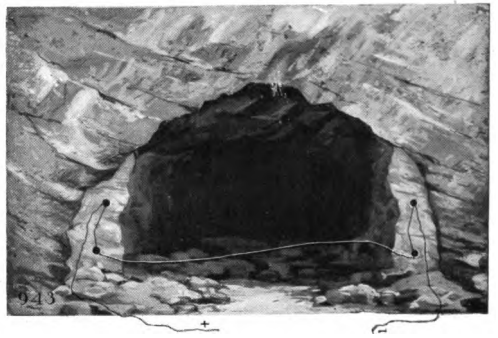

Ready to Blast Out Key Block




Ready to Blast Curtain Walls and Sides




Ready to Blast Curtain Walls Only




Final Blast

**Method of Blasting, Using Electric Fuses**

making a total cost of $1,440 by machinery, as against $2,500 by hand labor. Allowing $150 for interest and depreciation of machinery, we have a net saving of $910 by machinery, or, in other words, have saved $910 (on the shaft alone) to apply on the plant, which cost $1,300 and this on each 100 feet of shaft to be sunk.

### Cost with Machinery

If the work is to be "open cuts," the use of machinery will be equally advantageous, with a lower first cost of plant, as the compressor and receiver may be dispensed with and steam applied direct to the drill. On page 119 we give an illustration of a shaft-sinking plant, and an approximate estimate of what it would cost.

Some operators who have not had experience with our improved machinery are under the impression that in soft rock or minerals a hole can be put down by hand in the time required to get a drill ready to run. It should be remembered that the time spent in mudding or cleaning out a hand-drilled hole will more than offset the time it takes to get a machine ready, and as our drills have a run of from fifteen inches to two feet without stopping to mud there is a great gain over hand drilling. Many miners freely acknowledge that a machine will outdrill from 5 to 30 men, according to the nature of the material.

### Drifting

It must not be supposed that the usefulness of machinery stops at the bottom of the shaft. Headings have to be driven along the vein, and experience has proved that the saving over hand labor in heading work is even greater than in sinking work. An upraise is frequently to be driven, following the vein of ore up to the surface in some instances, thus giving another shaft for hoisting, ventilation or other purposes if needed.

The holes to be drilled in an upraise are nearly all "back" or "dry" holes. By hand this is the hardest kind of work a miner has to do. A machine drill does this work easily, the miner simply feeding the machine to its work.

### Stoping

For "stoping out" either the back or bottom of tunnels the drills are used to great advantage over hand labor. For

back stopes 3 to 8 feet wide, a plain shaft bar is used for mounting the drill, two men easily setting this light bar horizontally across the stope. A light set of tackle blocks is often used, one block being fastened to the bar or to a niche or crevice in the rock. The other block is attached to the drill quickly drawn up and fastened to the bar by one man, hose connected and drilling resumed in the regular way.

For underhand or bottom stoping in the wider veins the Sergeant Universal Joint Tripod will be found to give the best results, being light, easily handled and adjustable for putting holes in any direction or any place where men can work with hammers.

The mine having been opened up with this inexpensive plant and having proved profitable, additional machinery must be purchased. It will not be necessary or always advisable to lay aside the first compressor, as it can be connected up with the larger one, forming a battery with the advantage that should any accident occur to either compressor at least part of the work can be kept going.

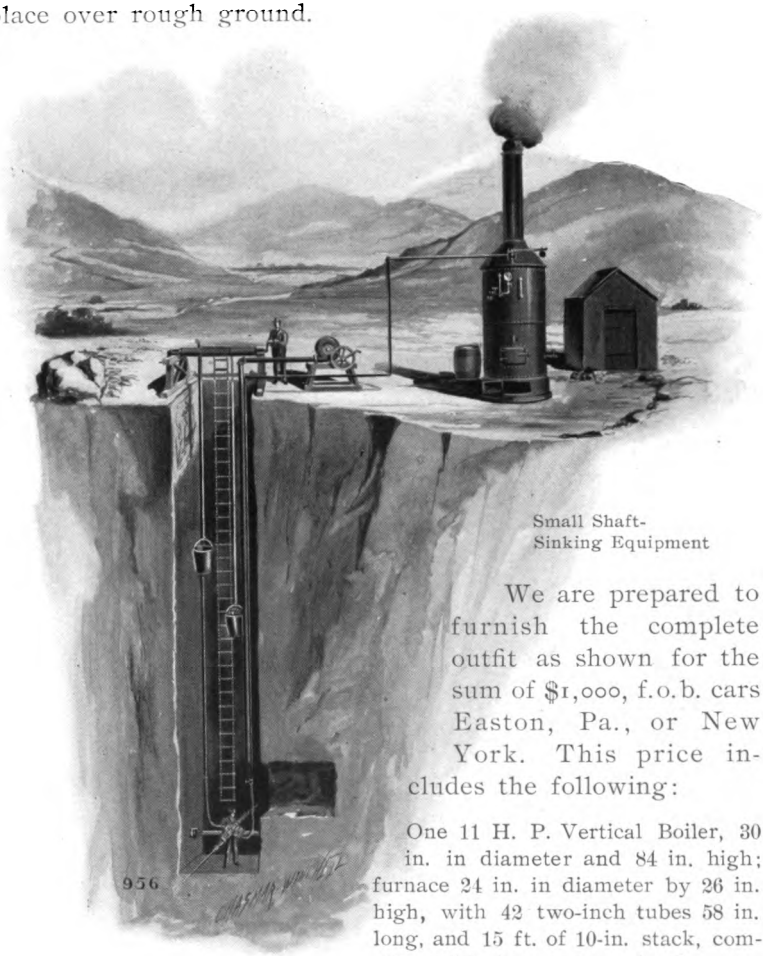
## Ventilation

Ventilation should not be lost sight of, and the majority of shafts sunk in the warm months require artificial ventilation. With an air drill in use a constant supply of fresh air is discharged directly at the working face, driving out the smoke and gases. After a blast has been made the hose can be turned loose and the whole capacity of the compressor used, cleaning out the smoke in a few minutes instead of waiting hours, as is often the case with hand sinking.

If water is encountered the air can be used for driving the pumps, while if steam were used the heat would be so oppressive that the men could not possibly do anything like as much work as they could in a cool shaft, with no hot water from the pump exhaust drizzling on them.

# Small Shaft Sinking Equipment

ON this page we illustrate an inexpensive shaft sinking plant suitable for prospecting or opening up coal or other mineral properties where the material is hard enough to require drilling or blasting. The equipment is very simple, and is easily moved from place to place over rough ground.




Small Shaft-Sinking Equipment

We are prepared to furnish the complete outfit as shown for the sum of $1,000, f.o.b. cars Easton, Pa., or New York. This price includes the following:

One 11 H. P. Vertical Boiler, 30 in. in diameter and 84 in. high; furnace 24 in. in diameter by 26 in. high, with 42 two-inch tubes 58 in. long, and 15 ft. of 10-in. stack, complete with base, grate, hood, water gauge, gauge, gauge cocks, safety valve, blow-off, check and stop valves and Hancock inspirator, with pipes and valves to attach to boiler.

Two hundred ft. of 1-in. Steam Pipe, threaded and fitted with couplings and necessary supply of unions and elbows, etc.

Two hundred ft. of 1½-in. Steam Exhaust Pipe, threaded and fitted with couplings and necessary unions, elbows, etc.

Twenty-five ft. of 1-in. 5-ply marline wound Steam Hose, fitted with couplings for attaching to drill and steam supply pipe.

Twenty-five ft. of 1½-in. marline wound Steam Exhaust Hose, fitted with couplings complete, ready for attaching to drill and exhaust pipe.

One "D" size Drill (either "32" or "24" type).

Two sets of Fitted Steels (3 pieces to the set), to 6 ft. long with plus (+) bits.

One set of Blacksmiths' Tools, for sharpening drills.

One portable Blacksmiths' Forge.

One set of general Blacksmiths' Tools, consisting of hammers, sledges and tongs.

One Blacksmiths' Anvil.

Two Sand Pumps.

One Single-screw Column or Shaft Bar, 4½ in. in diameter and 6 or 8 ft. long, with clamp suitable for mounting "D" size drill.

One Winch, with wooden frame and drum, 6 ft. long by 8⅝ in. in diameter; drum to be made of wrought-iron pipe and winch to have a capacity of 1,500 pounds, with two cranks, suitable for working by two men.

Two hundred and fifty ft. of 1-in. Manila Hoisting Rope.

Two cylindrical steel Mine Buckets, 22 in. in diameter by 28 in. deep.

One Rotary Blower, with necessary rigging to drive by hand. Blower to have 3½-in. outlet, with a capacity of about 175 cu. ft. of free air per minute.

Two hundred ft. of Rope Ladder, with rungs from 14 to 15 in. long and 1¼ in. in diameter.

Two hundred ft. of spiral-rivetted galvanized Iron Pipe, made of No. 20 B.W.G. stock and 5 in. in diameter, with slip joints.

One 5-in. galvanized sheet-iron Elbow.

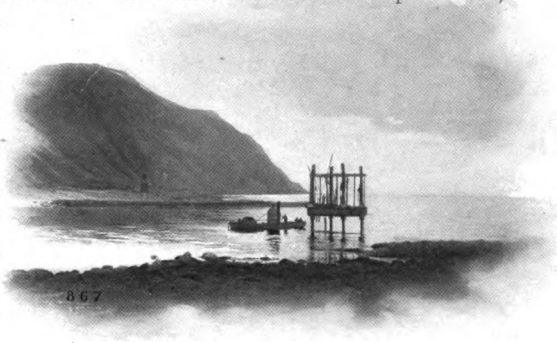
Two 18-in. Stillson Wrenches.

Packing, staples to hang air pipe, and incidentals such as spikes, oil, wire, etc.

# Submarine Rock Excavation

THE conditions under which submarine rock excavation must be done are difficult to the last degree, calling for special apparatus of unusual strength and endurance.

This character of work is nearly always carried on where tides, currents, wind and storms are present in varying degree, and these elements are completely antagonistic to rapid and economical work and formerly introduced such a factor of uncertainty as to require absolute daring to undertake river and harbor work. But add to these troubles deep water, irregular bottom covered over with mud, sand or other shifting material which fills in almost as fast as removed, and a combination of difficulties is formed which was until recently almost insurmountable.



Submarine Drilling, Platform Method, Norway

## Early Methods

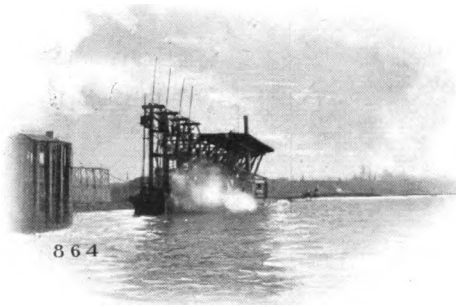
In the early days the usual methods were to lower explosives on the surface of the rock and attempt to fracture it by "surface blasting." Later a form of drop bar was introduced, by means of which holes were drilled and charges inserted, as is at present done. Still another form consisted of a very heavy cast iron bar tipped with a sharp steel point, which was raised and allowed to drop. The bars used in this method sometimes weigh as much as ten tons. In operation, the sharp point strikes the rock and is supposed to break off a certain amount with each blow. This system is used to some extent abroad even to-day, but in America has been abandoned entirely for the more progressive method of drilling a hole and inserting a charge of explosive, the same as is done in rock excavation on land.

The removal of submarine rock is daily becoming a more important feature, owing to the increasing depth of ocean and

lake-going vessels which demand deeper channels for our rivers and harbors. This growth has been gradual, and consequently very few, even among engineers, have any idea of the perfection to which means for excavation for submarine rock have been brought.

This is only possible because of the improvements which have been made in rock drills. To-day submarine rock excavation can be done far more cheaply, quickly and satisfactorily by the use of the improved Ingersoll-Sergeant submarine rock drill than by any other method known.

The drill which we have developed for this work, known as the Ingersoll-Sergeant Submarine Drill, is simply an enlargement and modification of our standard rock drills used in surface work. They are provided with a 5½-inch cylinder, and may be equipped with several forms of mountings to suit the character of work.



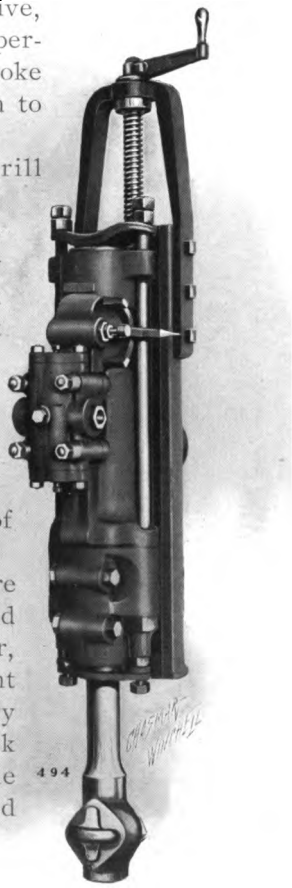

Submarine Drilling, Barge Method, England

# Submarine Drill (H 9 and H 17 Types)

IN modern submarine drilling steels are used anywhere from 30 to 60 feet in length and sometimes weigh as much as 400 pounds. To drill with such a steel in hard homogeneous material is a problem. In poor material and under water where the drill must be run by the "sense of feeling" the difficulties are multiplied and it is necessary to have a drill which is at once massive, powerful, durable, economical and capable of perfect control through all ranges of length of stroke and weight of blow, as well as strong enough to "go it blind" with the minimum of damage.

The Ingersoll-Sergeant Submarine Drill meets these conditions because it has been developed through years of experience in practically every submarine undertaking of any importance, embracing the pioneer work in New York Harbor, dozens of Government undertakings, the iron gates of the Danube in Prussia, Portsmouth Harbor, England, the Panama Canal, Havana Harbor, Cuba and Boston, and many important works in the Great Lakes, and other undertakings, both governmental and private, in all parts of the world.

Where formerly 4¼ and 5-inch drills were found ample for this work, we have adopted 5½ inches as the standard cylinder diameter, and except for this increase in size and weight and certain minor differences made necessary by the peculiar conditions of submarine rock excavation, the H 9 and H 17 drills are the same as all "New Ingersoll" drills described and listed on pages 46 and 49.




Ingersoll-Sergeant Submarine Drill H 9 Type

## Construction

This new submarine drill uses the standard "Ingersoll" cylinder with a small cushion valve in the passage leading to the back head end of the cylinder. The valve has a spring handle arranged to lock in whatever

position it may be placed. A modified "New Ingersoll" valve and chest are used with a guide screw fitting a slot in the valve, an arrangement dispensing with the guide bolt and nut. No cylinder buffers or washers are used, a very important improvement.

The piston, piston rod and chuck are forged in a single piece of special high-grade drill piston steel. The forging is straightened hot, accurately machined and subjected to an oil-treating process whereby the strength, wearing qualities and ability to stand the shocks resulting from the powerful blows are very largely increased.

The piston is then ground to a plug fit in the cylinder, proper allowance being made for expansion. Double sets of 3-segment piston rings are used on each end of the piston insuring tight fit and free-running and even wear on the piston and cylinder and good economy in steam consumption.

The chuck is exceptionally heavy with hardened chuck key and extra heavy U bolt. The drill is provided with the Sergeant rotation and cushion spring, new "15" style extra heavy front head and straight line through bolts into the heads of which are screwed the front head gland bolts, thus referring all the strains directly to the cushion springs. This head works equally well with steam or air.

All H 9 and H 17 drills are furnished with a link between the cylinder and through bolt on each side of the cylinder, which hangs over the head on each side and prevents the possibility of the front head and piston dropping into the water, should either of the through bolts break.

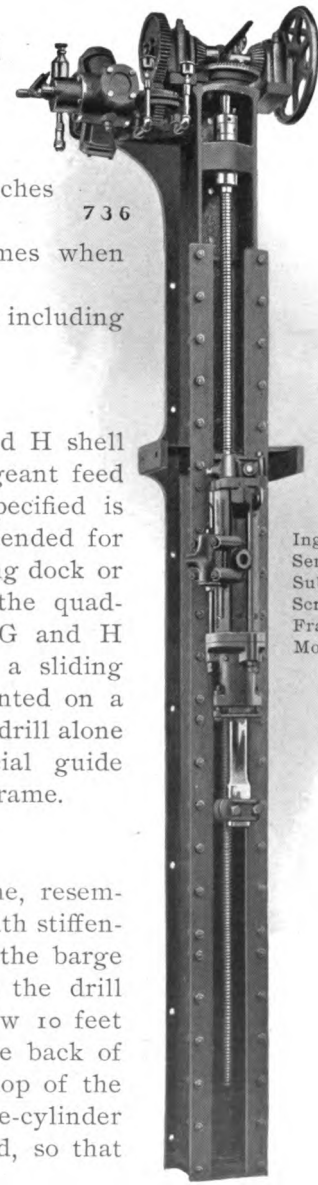
The valve chest has two small ports connecting the end of the valve cylinder with live steam or air from the supply port. The amount of opening in these discharge passages is controlled by two small regulating screws. By this means just the right amount of steam or air is admitted at either end of the main valve to compensate for wear of the valve, so that the drill gives a uniform rapid and full stroke until the valve is actually worn out.

Because of this feature, the use of the freely moving valve and the cushioning valve, a far more perfect control of the drill is possible than with any other type, and a short and light or a long, swinging, heavy blow may be struck. The large reserve power of the drill results in a prompt return even with the heaviest steels and in difficult material, the

steel lifting immediately the blow is struck. The drill has a high speed and will work for months in the most unfavorable conditions with only ordinary attention. It is solid, durable, and as simple as is consistent with a proper regard for the conditions to be met. Skillful operators, while making a better showing, are not necessary.

## Dimensions of H 9 Submarine Drill

Cylinder diameter, 5½ inches.
Length of stroke, 8 inches.
Length of feed, 30 inches.
Shank, 1¾ inches diameter by 7 inches long (larger when ordered).
Bushing, 1¾ x 6½ inches (sometimes when ordered, 2 x 6½ inches).
Weight of H 9 drill unmounted but including shell, 925 pounds.



Ingersoll-Sergeant Submarine Screw-Frame Mounting

## Mountings

The H 9 drill fits the regular G and H shell with Ingersoll cone and shell yoke, Sergeant feed screw and nut, and unless otherwise specified is always furnished with shell. When intended for Saunders platform work or drilling along dock or wall fronts the drill is mounted on the quadrant tripod, the same as the regular G and H drills, or the shell may be secured to a sliding frame running in suitable guides mounted on a barge or drill float. At other times the drill alone without shell is mounted on a special guide frame, known as the submarine drill frame.

## Submarine Drill Frame

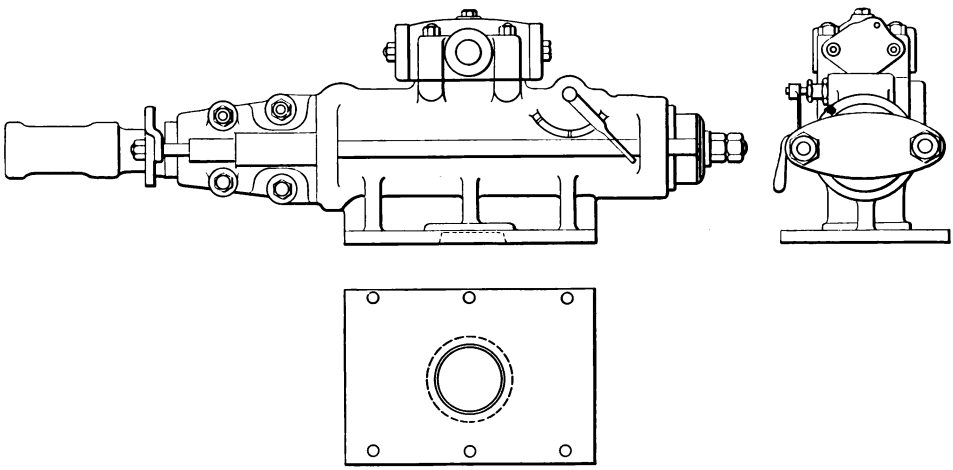
This is a substantial cast iron frame, resembling somewhat an exaggerated shell, with stiffening webs and flanges for attaching to the barge framing and suitable guides in which the drill slides. Inside the frame is a feed screw 10 feet long fitting the regular feed nut at the back of the drill. This screw hangs from the top of the frame and is geared to a small three-cylinder engine. A hand wheel is also provided, so that

the drill can be raised or lowered automatically or by hand, and by either method it may be fed down fast or slow, depending on the rate of cutting.

## Hydraulic Mounting

Another form of mounting, used very largely on the Great Lakes, and known as the hydraulic mounting, consists of a hydraulic ram of sufficient length to give the necessary amount of lift. Power for operating the ram is obtained from a small pump taking steam from the regular boiler.

For this form of mounting the shell is omitted and the drill furnished with a solid slab cast on the back of the cylinder. This slab is 18 x 12 inches, ⅞ inch thick, and has six bolt holes, and is ready to attach to the frame or moving part.



897

Ingersoll-Sergeant Submarine Drill, Slab Back, H 17 Type

When so fitted, the drill is known as the H 17 type, and has the same general dimensions as the H 9 previously described.

In ordering, customer should distinctly state whether H 9 type with or without shell, or H 17 type with slab back is wanted, and whether air or steam will be used.

To show superiority of the new H 9 Submarine Drill over the older H 2 type, the experience of a well-known dredging company in Buffalo harbor, can be cited. Working in hard black flint rock, the best record made by the older drill was from 10 to 12 holes in ten hours, the holes being 2

inches in diameter and 6 feet deep, first digging through from 5 to 6 feet of hard mud and gravel. The two H 9 drills started with a record of from 30 to 40 holes in the same material in 7 hours and maintained the rate. In this work was also found that the H 9 worked through seams almost as well as in solid rock. The new drill did not stick as the old drill did sometimes and required much less steam.

## Capacity

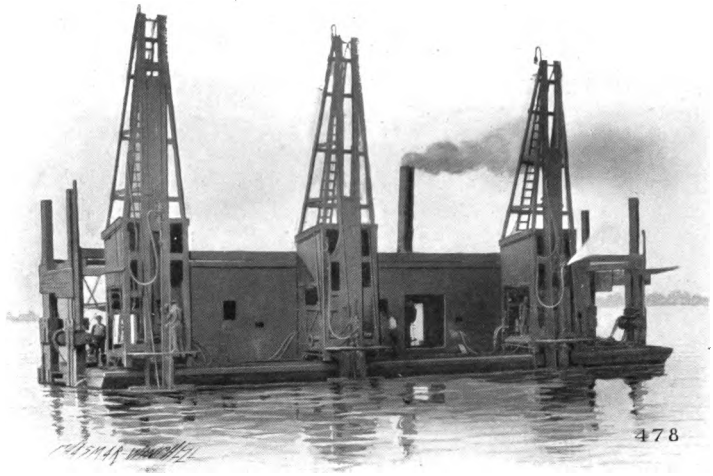
As to capacity, this depends so much on the nature of material and method of handling that no definite figures can be given. In some rocks the new drill is doing double and triple the work done by the old style 5 and 5½-inch drills, in others a half more to twice as much, but in all cases there is an enormous saving in cost of repairs and delays from breakages. Almost no repairs are required by the new type, since in the design great strength and endurance of parts was specially kept in mind, as well as economy in steam consumption.

SUBMARINE DRILL, H 9 AND H 17

| How Furnished | Price | Weight, lbs. | | Telegraph Name |
|---|---|---|---|---|
| | | Net | Shipping | |
| **H 9—Shell Type** | | | | |
| Drill without shell | $665 | 655 | 780 | Nuvavor |
| Drill with shell and unmounted | 700 | 925 | 1,100 | Nuvahs |
| Drill with shell mounted on tripod, complete | 765 | 1,590 | 1,870 | Nuvah |
| Submarine frame complete | 1,000 | 1,750 | 1,900 | Subobtuse |
| Drill mounted on submarine frame | 1,700 | 2,515 | 3,000 | Subocular |
| **H 17—SLAB BACK TYPE** | | | | |
| Drill with slab back | $700 | 580 | 680 | Nuvaslab |

NOTE. Prices and weights of steels, see page 65. Tripod, page 75.

The above prices are F. O. B. Easton or New York, and include steam head, improved throttle and oiler, and all necessary wrenches, duplicate part sheet and instructions.




Submarine Drilling—Barge Method, Detroit River, U. S. A.

# Systems of Submarine Rock Drilling

## Barge Method

A barge, scow or float is fitted with a suitable framing to support the drill guides, drills, boilers and other auxiliary apparatus. The barge is towed into place and anchored by means of cables, anchor chains or spuds, or a combination of these methods depending upon the rise and fall of the tide or the currents to be encountered.

The form of the framework depends largely upon the system used to feed the drill down, as the hole is cut into the rock. The height of the framing and length of feed depend upon the rise of tide and the depth of water over the rock and the depth to which the hole is to be drilled.

## Mountings

Three styles of mounting, or methods of raising or lowering the drills, are used. In one, the drill cylinder and working parts are suspended in long guides from a chain which passes over a sheave at the top of the frame and down to a drum on which it is wound, either by hand or power, or the drum may be at the top of the guide frame. Sometimes a platform is fastened to the slide or carriage and is raised or lowered with the drill, thus permitting the runner to be where he can always reach every part of the drill.

## Submarine Drill Frame

A second form, known as the Submarine Drill Frame, consists of a special guide frame resembling a very long drill shell in which the drill slides. Inside the guide is a special long feed screw and at the top is a small three-cylinder Sergeant automatic engine. The speed of this engine is under perfect control of the operator, so that the drill can be fed fast or slow. A hand feed is also provided, and the drill is under full control. This form makes an extremely compact and satisfactory mounting for deep water work, or where there is a considerable rise and fall of tide.

## Hydraulic Mounting

The hydraulic mounting is another satisfactory method. In this the drill and operator's platform are attached to the piston of a hydraulic cylinder, usually 5 or 6 inches in diameter and long enough to insure a proper length of feed. A small pump, accumulator and reservoir to maintain water pressure are provided, and by this means the position of the drill can be controlled absolutely, a turn of a valve securing the closest adjustment. This form of mounting holds the drill rigidly in place and does not spring back with each stroke and there is little to get out of order.

With any of these forms, one, two or more drills may be employed, each operating entirely independently of the other. In some cases each drill frame is mounted on rollers, running on tracks, so that each drill outfit can be shifted without moving the barge, thus permitting holes to be drilled within a few inches of each other, if necessary.

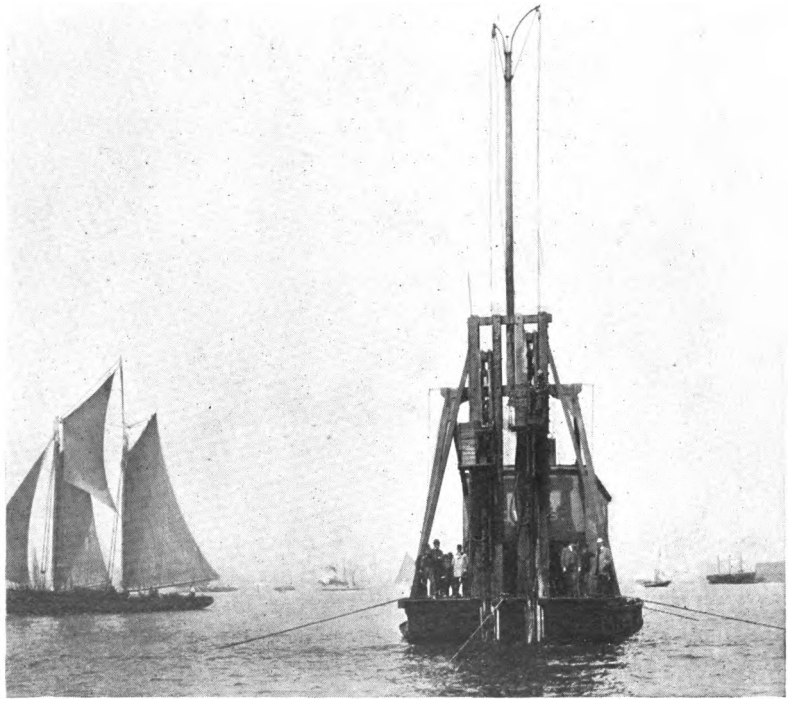
The boiler, pumps, winch engines for shifting the position, a supply of coal and all auxiliary apparatus are placed on the barge opposite the drills, thus balancing and making the equipment self-contained.

In operation, the barge is brought into approximate place, anchors are dropped and the winches used to bring the barge into the exact position. The drill is run to the top of the guide, the drilling or casing tube is lowered and driven down through the mud bottom to the rock by means of the water jet.

The first length or shortest steel is then clamped in the chuck, drilling then begins and each operator standing beside his drill feeds down with the control valve.

A small water tube is pushed down between the drill bit and the casing, as the drilling advances, so that the end is always close to the bottom. Water is forced through this under sufficient pressure to wash the mud and cuttings out of a side outlet in the tube, thus allowing the bit to always strike on clean solid rock.

After completing the hole, the casing or drilling tube is raised, sliding up outside the exploding wires. When all holes are charged, the exploding wires are connected, the joints being wrapped with insulating tape and the barge is shifted by winding in and paying out on opposite anchor ropes, until it is clear of the blast. The electric battery is then connected to the leading wires and the cartridges exploded in the usual way.



Submarine Drilling—Barge Method, Boston Harbor, U. S. A.

The barge is then brought back by means of the winches and a new series of holes drilled and the operation repeated.

By this means drilling may be conducted entirely above the water surface, and the most irregular bottom be leveled far more rapidly and cheaply than can possibly be done by any other method and without calling upon divers. With this system, drilling can be prosecuted in currents when it is impossible to work with divers or any other method.

Instances can be cited where ledges were removed in places where the average tide was 18 feet, and where currents as high as 6 miles per hour were encountered. Nor is it always necessary to remove the barge before blasting, for in average work where the depth of hole drilled does not exceed 4 or 5 feet, and the charge from 2 to 3 pounds of dynamite and depth of 15 feet or more of water over the rock, blasts can safely be made under the barge.

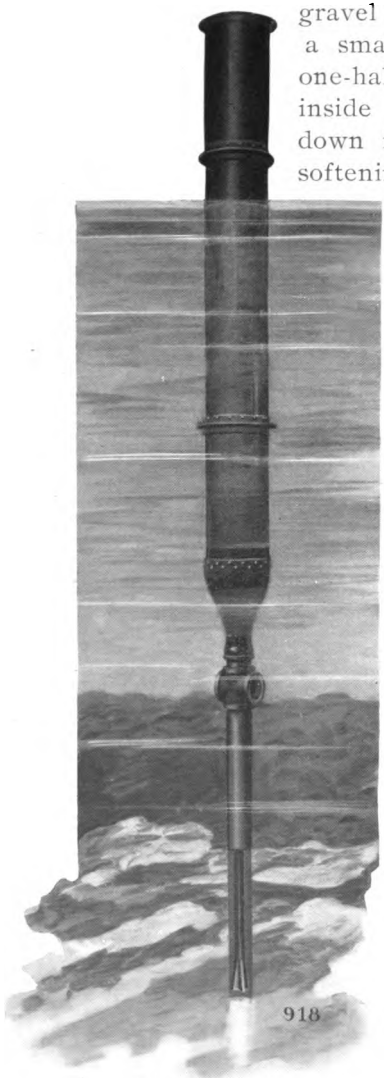
## Platform Method

This system is applicable to almost any kind of submarine rock excavation where depth and current are not exceptional, and is the simplest arrangement and one lending itself to small work in locations where barge drilling cannot be done.

This system consists of a platform or staging made of timbers braced to insure rigidity and provided with solid timber spuds of sufficient length to bottom at high tide. A-frame supporting a pipe or beam is rigged overhead, from which are suspended blocks and tackle or small chain hoists for raising and moving the drills, drill steels and casing tubes. The flooring of the stage has several longitudinal slots wide enough to admit the passage of the casing tube and the steels. To permit transportation, the platform is made floatable, either by supporting with pontoons or by attaching oil barrels.

An old scow, barge or the like accompanies the platform and on this is placed a boiler, a pump for supplying the boiler and water to clean the drill holes, and the necessary blacksmith's outfit for sharpening the drills, and other fittings and supplies. The boiler scow is anchored close to the stage and steam and water are conveyed across the intervening space by means of hose, while a suitable hinged gang plank allows free access for supplies.

In operation the stage and its boiler scow are floated into place, and the spuds dropped and the platform then raised above the level of the tide at high water, and in fact high enough to escape any wash from the waves. The scow is then moored, the drills placed on the platform, steam and water hose carried over and the submarine tubes placed and driven down to bed rock through the overlying mud, sand or gravel by the water jet. For this purpose a small pipe, say either three-eighths or one-half of an inch in diameter, is placed inside the large tube and the two pushed down into the mud, the jet all the time softening the material just ahead and permitting the tube to settle still further.



Submarine Drilling and Charging Tube

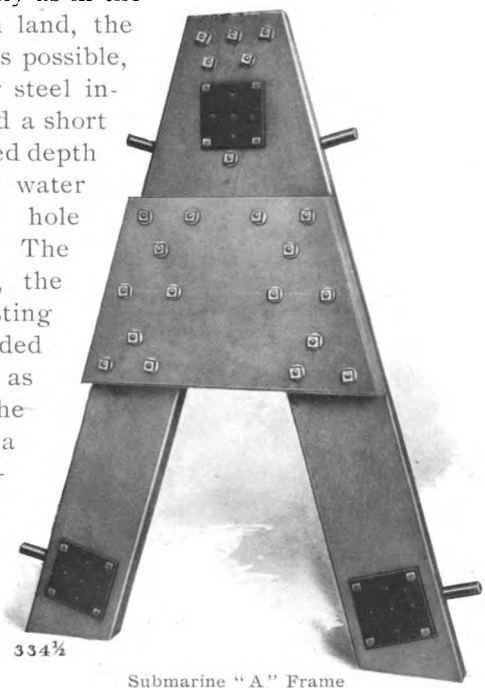
These submarine tubes are made in two forms either in sections of 4-inch wrought iron pipe jointed together with ordinary screw couplings, which form is used with continuous single piece steels, or a larger built up tube with a small end piece, which form is necessary when the special extension pieces and short steels are used.

When the casing rests on rock the drills are swung into place by means of the overhead rigging, the steels inserted and drilling begun, all the time allowing the water jet to remain in the tube.

Drills for use on this platform are mounted on the standard quadrant tripod which is set upon an "A" shaped frame made of timber and provided with metal plates for the tripod points to rest on, projecting pins are set in the sides of the frame for barring about, and staples are sometimes used for securing the frames to the platform

when they are in position. The purpose of this frame is to facilitate moving the drills about, and one man with a crowbar can shift the heaviest submarine drill by this means.

The holes are drilled exactly as in the case of drilling down holes on land, the drill being fed forward as far as possible, then being run back, a longer steel inserted or an extension piece and a short length, and so on until the desired depth is reached, when the steel and water jet tube are removed, the hole charged through the tube. The casing tube is then removed, the wires connected with the blasting battery and the charges exploded without moving the platform, as the worst that can happen is the breaking of a spud, and this is a rare occurrence, and in one instance blasts of some hundred pounds of dynamite under such a platform only broke one spud.



Submarine "A" Frame

Another advantage of the platform system is that the platform can be cheaply and quickly constructed with materials always at hand, and when the work is completed it may be dismantled and the drills used on land without any alteration.

Plants of this type using Ingersoll-Sergeant drills were employed for the harbor work at Piræus, Greece; at St. Peterport, Guernsey, Holyhead Harbor, Plymouth, New Harbor Works at St. Helena, Jersey, by the Norwegian Government for harbor work, and in connection with many other submarine undertakings.

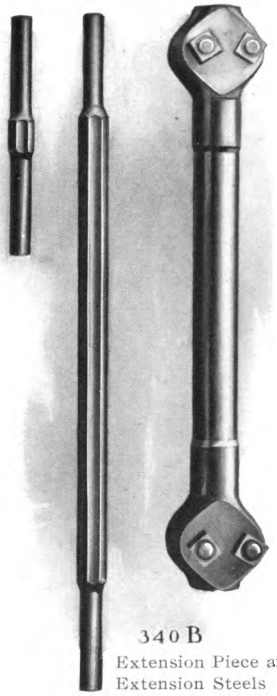
If considering any sort of submarine rock excavations, write us for the benefit of an extensive experience, submit full data and we will suggest an equipment to meet your conditions at the least cost.

## Submarine "A" Frame

This is a heavy V-shaped frame of oak timber, with flat metal plates in the corners and barring pins on the

sides of the timbers. These frames are of material assistance in submarine drilling or wherever G or H drills are used on a drill platform. The tripod once set up requires no further attention, as the points rest in holes in the corner plates of the "A" frame. When it is necessary to move the drill, one man, with the aid of a crowbar, can easily move the frame and drill about the platform.

Price, $50. Weight, about 250 pounds. Code Name, PACIENDO.



340 B
Extension Piece and Extension Steels

## Extension Piece

When using a standard drill mounted on tripod for submarine work, an extension piece is generally employed. This is a steel piece with a regular chuck and "U" bolt on each end, which permits the use of ordinary drill steels for deep drilling.

Price, $38. Weight, 150 pounds. Code Name, PACIENTES.

## Extension Steels

When using the extension piece it is necessary to have lengths of octagonal steel. These have a shank forged on each end. In use one shank is fitted into the drill chuck and the other into the extension piece chuck, the regular drill steel being slipped into the other end of the extension piece. These are made of 1¾-inch steel with 1¾-inch shanks.

Price, per foot of length, $1.70. Weight, per foot of length, 10 pounds. Code Name, PACIENZUDO.

## Submarine Tube

Whenever the extension piece is used a submarine tube is necessary for both drilling and charging. This is made in sections of about 5 feet long, which can be bolted together for any desired length. See page 132.

Price, end section and one upper section, $75.
Diameter, end pipe, 4 inches; upper tube, 12 inches.
Length, end pipe and upper tube, 5 feet.
Weight of first section, including end pipe, "T" and enlarged tube, 100 pounds.
Weight of additional foot of upper tube, 11 pounds.
Code Name, end section, PACIESEMOS.
Code Name, each 5-foot section, upper tube, PACIFEROS.

# Ingersoll-Sergeant Pile Driver

IN sewer excavation and trench or foundation construction it is generally necessary to use sheet piling. Especially is this true with dock improvements, embankment work and foundations of bridges where water or quicksand is encountered.

Heretofore driving sheet piles has been a matter of difficulty, involving the use of heavy mauls and the constant attention of a gang of men. This is particularly true in the case of very deep trenches, where two or three courses of piles are necessary. In hard ground it is sometimes almost impossible to drive sheeting in this way, and at best the ends are split or so badly abused that the tops are sprung apart requiring that they be cut off to find solid wood to hit on in order that the driving may continue.


Method of Using
Ingersoll-Sergeant Pile Driver

As an improved, rapid and economical means of driving sheet piles, the Ingersoll-Sergeant Automatic Pile Driver is a valuable adjunct to any contracting plant. It is a self-contained machine which, when placed on top of the pile, drives it rapidly and evenly, following all the way down with little attention or handling on the part of the operator.

The machine resembles the standard "New Ingersoll" Rock Drill, with the addition of a striking anvil. It may be operated by either steam or compressed air, fast or slow, with a heavy or light blow,

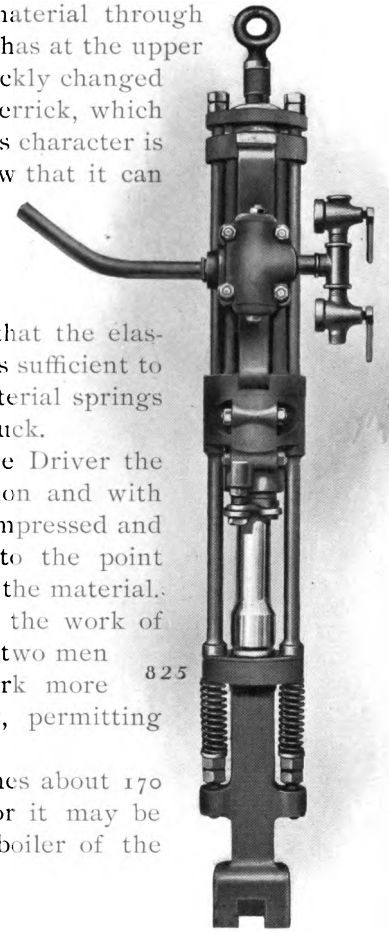
according to the character of the material through which the pile is to be driven. It has at the upper end a lifting staple and may be quickly changed from pile to pile by hand or by the derrick, which is usually present where work of this character is in progress. The driver is so narrow that it can follow down with the pile without interfering with its neighbors.

One of the troubles of the ordinary way of pile driving is that the blows are so slow and so light that the elasticity of the upper end of the pile is sufficient to absorb most of the blow and the material springs back before a second blow can be struck.

With the Ingersoll-Sergeant Pile Driver the blows follow in such rapid succession and with such force that the entire pile is compressed and the full blow transmitted at once to the point where it causes the pile to penetrate the material.

One of these machines will do the work of from 15 to 20 men and requires only two men for its operation. It does the work more rapidly and far more satisfactorily, permitting tighter joints and longer piles.

When operated by air it consumes about 170 cubic feet of free air per minute, or it may be operated by steam taken from the boiler of the hoisting engine.



Ingersoll-Sergeant Sheet Pile Driver

Diameter of cylinder, 4 inches.

Length over all, 5 feet 6 inches.

Size of jaw, 6 inches long, 2½ inches wide.

Distance from centre line of cylinder to back, *i. e.*, minimum clearance necessary, 3¾ inches.

Complete, ready for operation, it weighs 330 pounds.

The shipping weight is 400 pounds.

List price, packed ready for shipment f. o. b cars Easton, Pa., and including lifting staple, throttle, oiler and wrenches, is $625.

Code name, PILTOD.

# Blasting Outfit

THE cartridges used are in all respects the same as would be employed with the tape fuse, the difference beginning and ending with the exploder and the method of exploding; consequently, a blaster does not have to unlearn anything that he already knows, and it is not necessary for him to learn very much in addition.

The "exploder," "platinum fuse" or "electric exploder," as it is often called, consists of a small shell of copper, A, partially filled with fulminate of mercury, B, which is sealed in the tube by a sulphur cement plug, F. Through this plug and projecting into the fulminate are the ends of the two exploding wires, C. Across the end of these, D, is soldered a small, short piece of platinum wire, E. This wire becomes red hot when the current passes through it and, imbedded as it is in the fulminate, an explosion immediately occurs, and the force of this, owing to its confinement in the copper shell, instantly detonates the main cartridge or charge. These fuses are made with wires from 4 to 30 feet long, increasing by lengths of two feet (see table page 140).

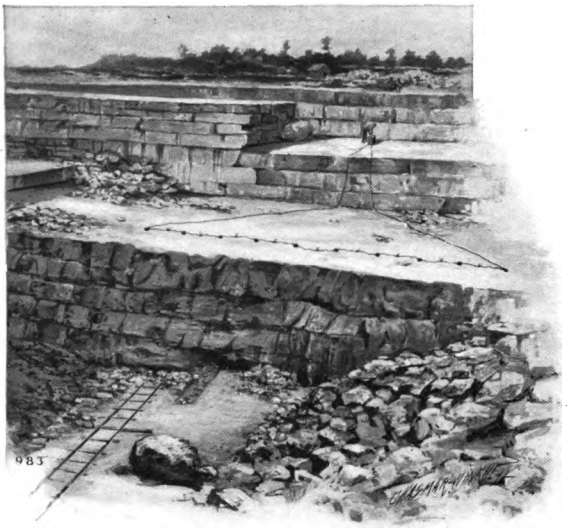
Electric Exploder

The drilled holes are charged in the usual way, ordinary care being exercised in tamping not to cut the wires, but this danger is far less liable than when the tape fuse is used. The wires are then joined together by short lengths of connecting wire, so that the current passes through all cartridges on its way back to the battery. To the first and last end wires the leading wires to the battery are attached.

These are especially well insulated, usually 500 feet long, although in the case of very heavy blasts lengths of 1,000 feet are more often used. These leading wires after connecting are run along the ground to some protected place and are here connected to the binding screws of the blasting battery.

The joints or splices of the wire are either blocked up so that the bare wire cannot touch the ground or are wrapped with an insulating tape to protect them and insure the electric

current passing through all the cartridges. In wet localities, underground, and always in submarine work, this insulating of joints must be done.



Method of Connecting up and Firing a Series of Holes

## How to Use the Blasting Battery

Having placed the cartridges, tamped the holes, connected up and run the leading wires to the blasting battery everything is ready to shoot the blast. *Be sure that all men are at a safe distance and that everything is ready.* Now grasp the handle of the blasting battery and raise it slowly to its full extent, then push down with a slow stroke, steadily increasing in force until the bar strikes the bottom with a solid thud. Do not churn the rack bar up and down as this does harm and will not make the blast quicker nor surer.

One thing must be borne in mind at all times, and that is each blasting battery has a definite capacity, beyond which it cannot be used; in other words, if you have the 25-cartridge machine it should never be used beyond 25 or else you can count on failure to explode. Keep the battery out of the sun, in a cool place, protected from dampness, and don't abuse it.

# "Push" or Magneto-Electric Blasting Machine

Magneto-Electric Blasting Machine

THIS blasting machine consists of a small but powerful magneto-electric generator operated by a rack, the whole being enclosed in a strong wooden case, provided with binding screws for connecting the wires, a handle for working the generator and a leather lifting strap. It is recognized as the strongest and most powerful on the market, and is especially adapted for quarrying, railway, mining or submarine work.

Three capacities are furnished.

| Number | Telegraph Name | Firing Capacity | Price |
|---|---|---|---|
| 3 | Pachylepis | 20 to 35 Holes | $25.00 |
| 4 | Pachylope | 35 to 75 Holes | 50.00 |
| 5 | Packsattel | 1 to 10 Holes | 15.00 |

The largest size No. 4 weighs about 50 pounds and occupies less than half a cubic foot.

We also furnish a smaller size for prospecting or work where only a few holes are fired at a time.

| Number | Telegraph Name | Firing Capacity | Price |
|---|---|---|---|
| 1 | Pachyma | 1 to 8 Holes | $12.00 |

Weight, about 15 pounds.

## Electric Platinum Fuses

Fuses or exploders are embedded in the cartridge, and are made with wires of lengths to suit the depth of hole drilled. They are also made single strength for dynamite and double strength for certain grades of powder or submarine blasting. The wires are double cotton insulated, also covered with a waterproofing material, and are tested and

warranted of full strength. Fuses are folded separately and carefully packed in boxes containing 50 each.

PRICES OF ELECTRIC FUSES IN LOTS OF 100

| Telegraph Name Single Strength* | Length of Wire Feet | Strength | |
|---|---|---|---|
| | | Single | Double |
| | | Ordinary Quality Regular Strength | Extra Quality Double Strength |
| Pachymere | 4 | $3.00 | $3.75 |
| Pachyneme | 6 | 3.54 | 4.29 |
| Pachyodon | 8 | 4.08 | 4.83 |
| Pachyonyx | 10 | 4.62 | 5.37 |
| Pachyote | 12 | 5.16 | 5.91 |
| Pachypalpe | 14 | 5.70 | 6.45 |
| Pachypezes | 16 | 6.24 | 6.99 |
| Pachypede | 18 | 6.78 | 7.53 |
| Pachyrhine | 20 | 7.32 | 8.07 |
| Pachysaure | 22 | 8.32 | 9.07 |
| Pachyscele | 24 | 9.32 | 10.07 |
| Pachysome | 26 | 10.32 | 11.07 |
| Pachystole | 28 | 11.32 | 12.07 |
| Pachyterie | 30 | 12.32 | 13.07 |

* Telegraph name for double strength, add DOUBLE to name for single strength.

Longer lengths made to order; special prices for quantities.

## Connecting Wire

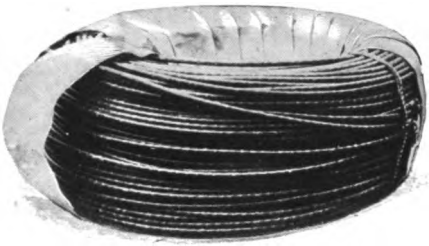
This wire is for connecting charges in holes. It is made of pure copper, size No. 20, B & S, and is carefully insulated and waterproofed. We furnish it wound on spools at the price of 40 cents per pound.

Spool of Connecting Wire

| Telegraph Name | Quantities | Price |
|---|---|---|
| Pachyure | 2 pound spool about 500 feet | $0.80 |
| Paciaire | 5 pound spool about 1,250 feet | 2.00 |
| Paciamos | 10 pound spool about 2,500 feet | 4.00 |

## Leading Wire

For connecting charged holes with the blasting battery when ready for firing. This is also a copper wire carefully insulated and as usually furnished it is in coils containing 250 or 500 feet.



Coil Leading Wire

| Telegraph Name | Quantity | Price |
|---|---|---|
| Pacidejano | 250 Feet | $2.50 |
| Paciencia | 500 Feet | 4.00 |

In smaller quantities, at the rate of 1 cent per foot.

## Insulating Tape

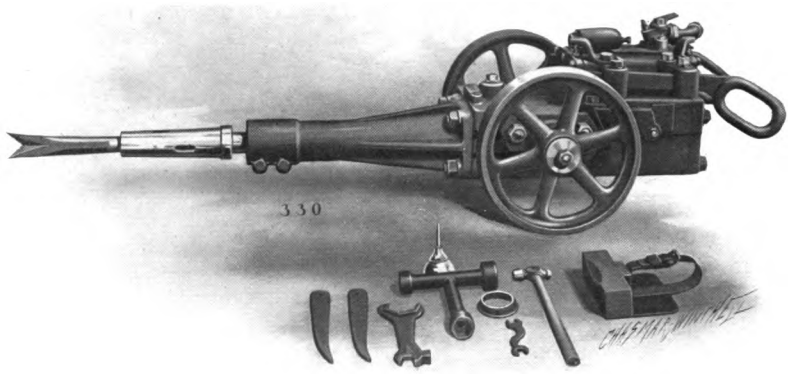
For insulating joints in large blasts, where water is present or in submarine work.

PACIFICH ; in rolls, $1.50 per pound.

# The "New Ingersoll" Coal Machine

IN addition to making rock drills and other metal mining machinery, we are also the largest manufacturers of *compressed air coal cutters*, of which we are manufacturing a new type, having several very great advantages over all earlier constructions.

The mining of coal presents a field and opportunity quite as broad as the use for rock drills, but this is a subject in itself which cannot be fully gone into here. We issue a special catalogue, No. 51, entitled, "Compressed Air in Coal Mines," describing the "New Ingersoll" Coal Machine, and discussing the various practical applications of compressed air to coal mining. This catalogue will be sent to those interested on request.

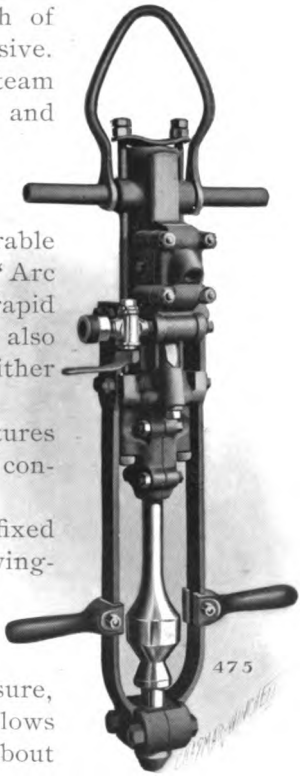



Ingersoll-Sergeant Coal Cutter, "New Ingersoll" Type

# Drift Bolt Driver

THE construction of cribs, caissons, docks and other heavy timber structures usually involves the driving of a larger number of heavy spikes or drift bolts. Heretofore these bolts have been driven with hand sledges or improvised hammers, both of which methods are crude, slow and expensive.

The possibilities of using air or steam for this work early attracted attention, and after several years of experimenting we offer the improved portable drift bolt driver shown on this page.




The driver embodies all of the desirable features of the A 32 Ingersoll-Sergeant "Arc Valve Tappet" drill, with its positive, rapid and powerful blow. The tappet feature also admits of the driver being operated by either steam or compressed air.

Certain modifications and special features have been introduced to meet the peculiar conditions inherent to the work to be done.

This driver is provided with a pair of fixed handles at the upper end, one suitable swinging lifting bail, two sliding adjusting handles, improved throttle, and a set of wrenches for adjusting all nuts and bolts.

With air or steam at 70 pounds pressure, the machine strikes approximately 500 blows per minute, each of which has a force of about 250 pounds.

The machine is light, durable and efficient, and is the most rapid means known for driving drift bolts.

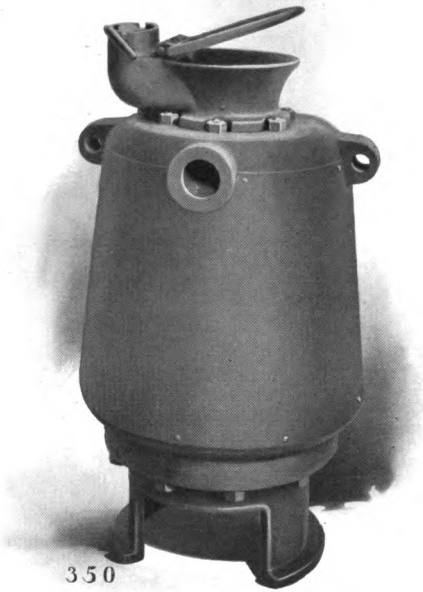
Weight, complete, 125 pounds.

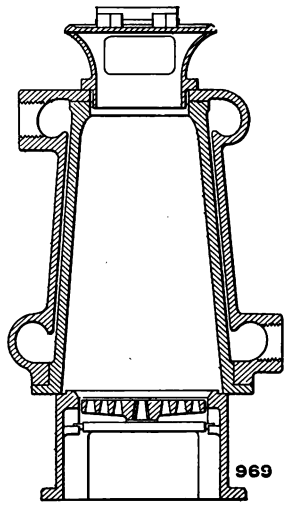
Price, $350.

Code Name, PACKSCHIFF.

# Reheaters

THE use of reheaters is advised in many cases and always where air is to be transmitted long distances and used out of doors. The air in passing through the heater is expanded, its volume increasing to a degree depending upon the amount of heat imparted to it, thus increasing the capacity of the air plant. Under favorable conditions with the heater close to the working apparatus a gain of 30 to 35 per cent. results.




Section of Standard Reheater

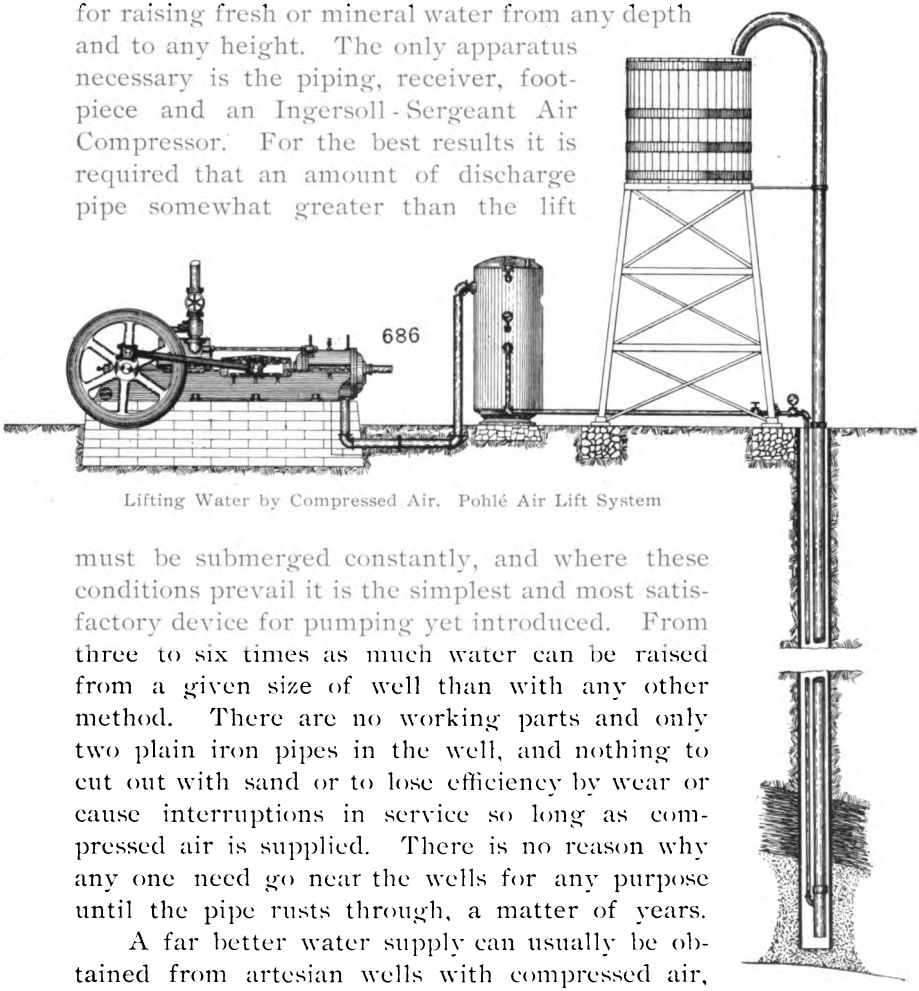
## Standard Reheaters

| Telegraph Name | Size Number | Dimensions | | | | Weight | Capacity Cubic Feet Free Air per Minute at 80 Pounds | Final Temperature Degrees Fahr. | Increased Volume Per Cent. | Price |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Outside Diameter, Inches | Height Inches | Inlet and Outlet, Inches | Sq. Ft. Heating Surface | | | | | |
| Packtasche | 1 | 17 | 31 | 2 | 7½ | 400 | 200 | 250 | 30 | $100 |
| Packthier | 2 | 42 | 56 | 4 | 22 | 2,300 | 550 | 250 | 30 | ~~250~~ 1704 |

# The Air Lift

WE have perfected the Air Lift system and have installed a large number of plants for railroad, manufacturing purposes and city water works service. The experience gained is at your service.

The system is used generally in artesian or driven wells for raising fresh or mineral water from any depth and to any height. The only apparatus necessary is the piping, receiver, foot-piece and an Ingersoll-Sergeant Air Compressor. For the best results it is required that an amount of discharge pipe somewhat greater than the lift must be submerged constantly, and where these conditions prevail it is the simplest and most satisfactory device for pumping yet introduced. From three to six times as much water can be raised from a given size of well than with any other method. There are no working parts and only two plain iron pipes in the well, and nothing to cut out with sand or to lose efficiency by wear or cause interruptions in service so long as compressed air is supplied. There is no reason why any one need go near the wells for any purpose until the pipe rusts through, a matter of years.

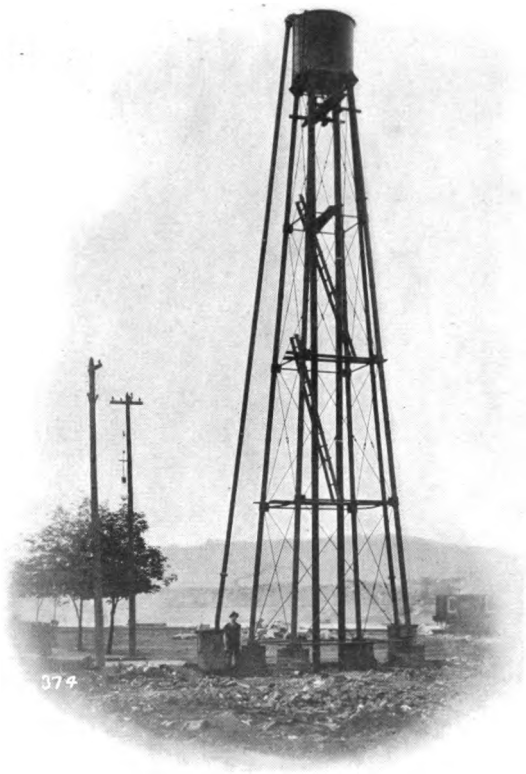



Lifting Water by Compressed Air. Pohlé Air Lift System

A far better water supply can usually be obtained from artesian wells with compressed air, and owing to the purifying of the water through its contact with the air it is rendered suitable for use in boilers, general manufacturing or city water works. The system is

coming into very general use and is doing much in the direction of furnishing a water supply in a very simple manner, and often where it could not be obtained in any other way.

Its use for draining mines and quarries, however, is not often advised because of the submergence or pumping head required, but a well may be sunk in the low corner where it will not tap additional water veins, or it can be cased. Compressed air is now applied to various other methods of pumping, some of which will meet practically any conditions with great economy.




Showing Air Lifting to a High Tank

# Haeseler "Axial Valve" Hammers

THROUGH the Haeseler-Ingersoll Pneumatic Tool Company, we are now prepared to furnish a complete line of pneumatic hammers for riveting, chipping, calking and flue beading, as well as stone cutting tools.

These hammers are the best yet produced, and are offered to customers of The Ingersoll-Sergeant Drill Company with full confidence, as they include every feature of design and excellence of workmanship and


Haeseler-Ingersoll Long Stroke Riveting Hammer

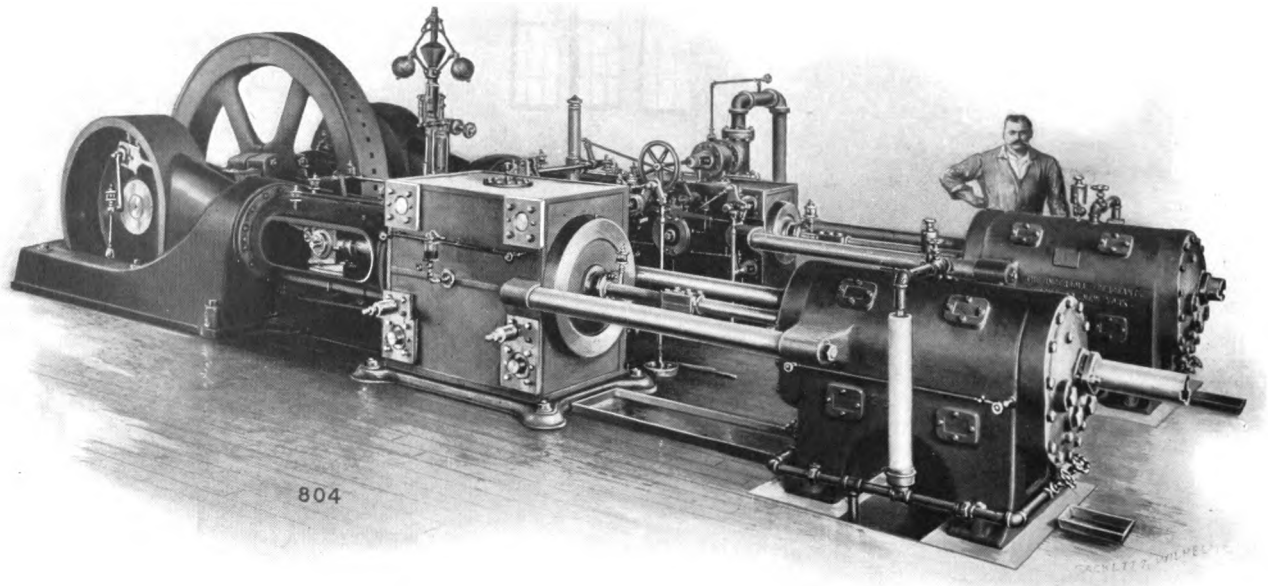
material necessary for the satisfactory working of a pneumatic hammer. They are offered only after a series of thorough and exhaustive trials which have demonstrated beyond dispute the correctness of this design.

The valve mechanism of these tools is a radical departure from the types heretofore employed, and by its use are avoided the principal difficulties experienced with pneumatic hammers employing the ordinary forms of straight line reciprocating valve construction.

This new valve, appropriately named "AXIAL VALVE," moves about on an axis or trunnion at right angles to the movement of the hammer piston, and is not affected by the blows struck by the hammer. This feature tends to reduce the vibration which is a serious fault in hammers on the market at the present time.

While this single improvement is sufficient to secure the attention of any one interested in the use of pneumatic hammers, there are other improvements of importance, all combining to make the Haeseler "AXIAL VALVE" hammer the most compact, simple, strong and durable tool of that character.

For prices and full information write the nearest branch house of The Ingersoll-Sergeant Drill Company, see page 5, or refer to The Haeseler-Ingersoll Pneumatic Tool Company, 26 Cortlandt Street, New York.




Ingersoll-Sergeant Cross Compound Corliss Compressor

# Air Compressors

INGERSOLL-SERGEANT Rock Drills and Air Compressors have become so closely associated that we merely mention compressors in this publication and refer you for particulars to our special Air Compressor Catalogue, No. 35.

We manufacture eleven distinct types of compressors and about 600 standard sizes. The different designs are to meet the diverse conditions in shop and mine, above and below ground. They differ in capacity from those with an output of a few cubic feet per minute to about 9,000 cubic feet, as in the case of several cross-compound Corliss Compressors which we have installed for a large mining concern in the West. The same company has twenty-nine Ingersoll-Sergeant Compressors with a rated output of about 70,000 cubic feet per minute, and also some 750 rock drills.

We have built compressors for every possible service calling for pressures from a few pounds up to 5,000 pounds per square inch, and the annual output of the Ingersoll-Sergeant works is over 68,000 horse power of air and gas compressors, and extensions which are now under way will largely increase the capacity of our works.

We carry a large stock of patterns for special compressors and are thus able to fill promptly orders for high pressure compressors or machines to meet peculiar conditions such as mule back transportation in mountainous or inaccessible regions or for driving by water power, electric motor, gas or oil engines.

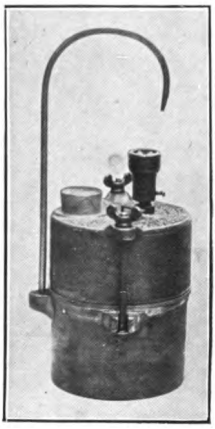
Some of these compressors are not intended for mining purposes and we suggest that you leave the selection of type to us, relying upon our experience to advise the right compressor.

The compressors we offer are the result of thirty years of experience under every possible condition. Each compressor is correct in principle and as nearly perfect as it is possible to make it with modern machinery and skilled labor in the largest and best equipped works in the world devoted solely to the manufacture of rock excavating and air and gas compressing machinery.

Prices, specifications and full information sent on request.

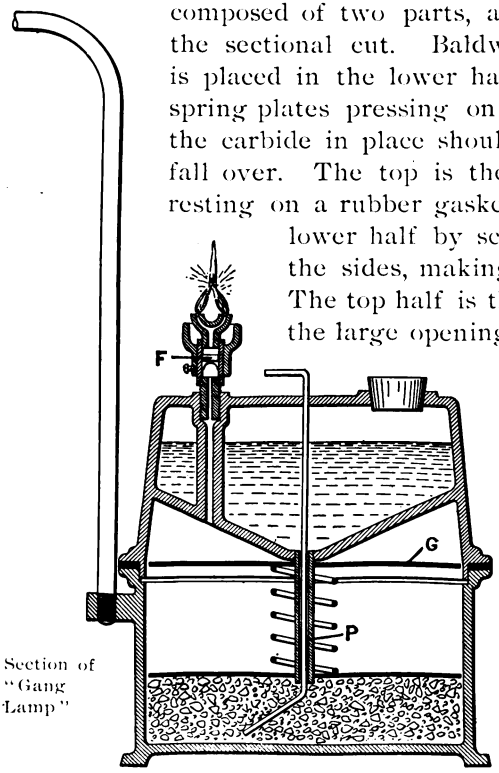
# Baldwin Acetylene Mine Lamps

THESE lamps are intended for mines, tunnels or general contracting or construction work or wherever a powerful penetrating light is wanted and where an open flame lamp can be used. They are the best form of lamp for confined work, as they remove less oxygen, produce less carbonic dioxide and water vapor than any other commercial means of illuminating except electricity. They produce no smoke or smell and are absolutely safe. They are economical and durable, and all in all far superior to any form of oil or gas lamp.



Baldwin Acetylene "Gang Lamp"

The lamps are made of cast iron so as to be practically indestructible, and are composed of two parts, as shown by the sectional cut. Baldwin carbide is placed in the lower half with the spring plates pressing on it to keep the carbide in place should the lamp fall over. The top is then put on, resting on a rubber gasket (G) and is clamped to the lower half by screwing up the wing nuts on the sides, making a perfectly gas tight joint. The top half is then filled with water through the large opening on top. Water runs slowly down the central tube to the carbide where the chemical action takes place and the acetylene gas is given off. This gas as fast as produced passes up through pipe (P) to the burner, being filtered through a felt plug (F) just under the burner.




Section of "Gang Lamp"

A pressure of about 2½ ounces to the square inch is required to provide a proper supply at the burner. The tube through which the

water passes is nearly closed by a wire, and is so arranged that as the gas pressure is greater or less in the gas chamber, the flow of water is automatically controlled thereby, according to the requirements of the lamp. If for some cause the gas pressure goes above 3 ounces to the square inch, this pressure cuts off the water entirely, the gas escaping up the water tube which then acts as a safety valve, holding back the water till the pressure becomes normal.

The lamps are so constructed they may fall on their sides, or roll over without causing any trouble or extinguishing the light. The iron hooks can be turned around if the lamp is to be hung up.

## Sizes, Dimensions, Prices

These lamps are made in two styles, the "Superintendent's Lamp," intended for superintendents, mine bosses and surveyors, a small nickel-plated hand lamp burning four hours on a charge of three ounces of carbide, and the "Gang Lamp" a heavy working form made in three sizes:

ACETYLENE MINE LAMPS

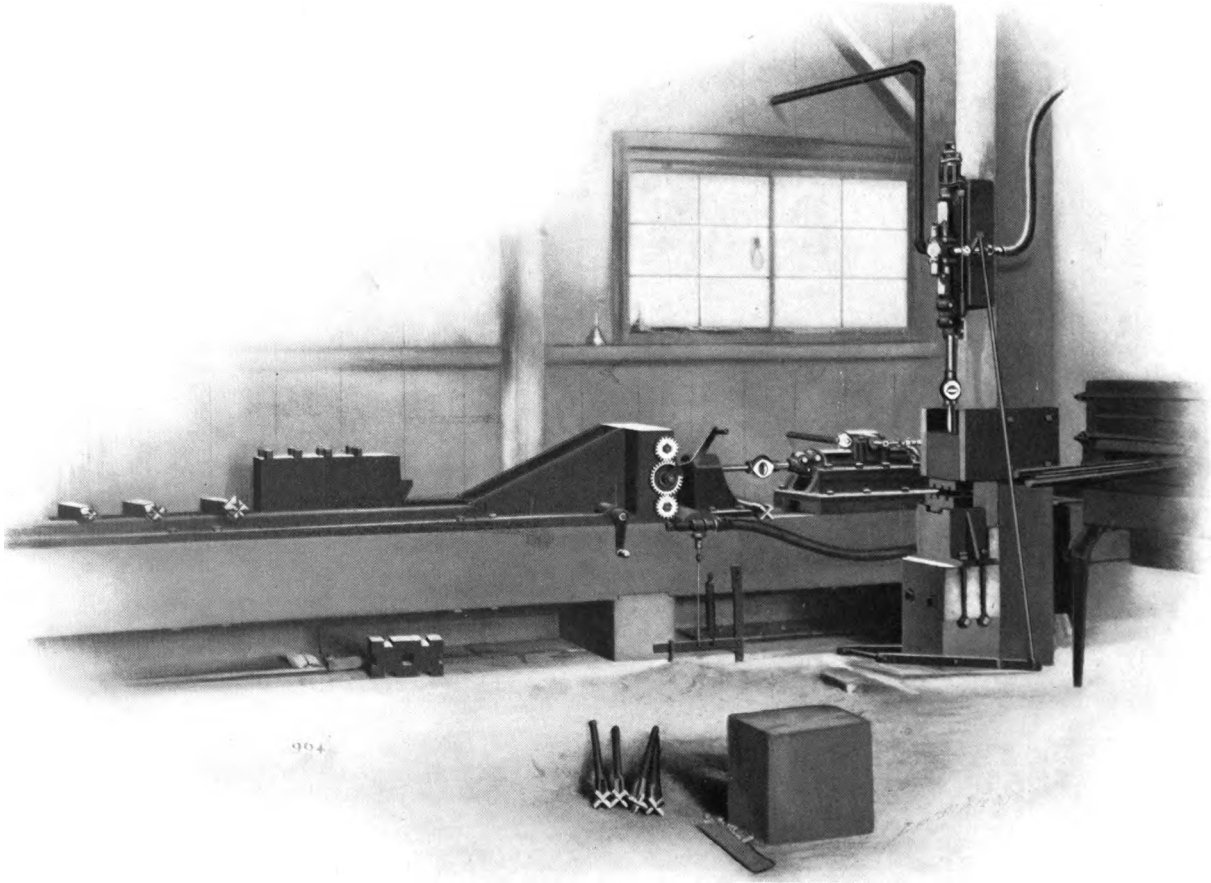
| Type No. | Size | | Weight | Size of Burner Cubic Foot per Hour | Weight of Carbide per Charge Ounces | Time One Charge Lasts Hours | Candle Power | Price Each |
|---|---|---|---|---|---|---|---|---|
| | Diam. Inches | Height Inches | | | | | | |
| Superintendent's | 2¾ | 7 | 9 oz. | .... | 3 | 4 | 30 | $2.00 |
| 7 | 5 | 6 | 7 lbs. | ¼ | 6 to 12 | 6 to 12 | 10 | 4.50 |
| 8 | 6½ | 6½ | 11 " | ½ | 10 to 20 | 6 to 12 | 20 | 5.00 |
| 9 | 8½ | 6½ | 20 " | ½ | 20 to 40 | 9 to 18 | 20 | 7.50 |
| 9 | 8½ | 6½ | 20 " | ¾ | 20 to 40 | 6 to 12 | 30 | 7.50 |

## Calcium Carbide

Only specially prepared carbide can be used in these lamps. This carbide in 100 pound drum costs 5 cents per pound, f. o. b. New York, or with freight added about 6 cents per pound at the mine. It is also packed in sample packages of 2, 5 and 10 pound cans.

## Baldwin Carbide, Specially Prepared

2-pound can, f. o. b. New York ..... $0 25
5-pound can, f. o. b. New York ..... .50
10-pound can, f. o. b. New York ..... .75
100-pound drum, f. o. b. New York ..... 5.00



Ajax Drill Steel Sharpening Outfit

# Ajax Drill Steel Sharpener

MINE operators, contractors and others engaged in work where a number of rock drills are used, will find it to their interest to investigate the merits of the Ajax Drill Steel Sharpener, illustrated on the opposite page.

The Ajax Sharpener is an apparatus for sharpening drill steels by power instead of by hand. Its operation is such that the bits are formed in the same manner as when hand forged, but the cost of the work is materially reduced and the output of the blacksmith's shop largely increased.

## Capacity

Its capacity is about 1,200 steels in 24 hours, the time for each steel ranging from 30 seconds to one minute. Bits sharpened in this way are more regular and better than when hand sharpened, and the opinion of those using the Ajax Sharpener is that the machine forged bits will put down from 100 to 300 per cent. more holes than those sharpened by hand.

At the United Verde and Homestake mines, one Ajax machine in each case now does the work formerly requiring 12 men, and the air required to sharpen 600 drills in 10 hours is about one-fifth as much as is required to run one 3-inch drill underground.

As a further idea of the large saving which results from the use of this machine, we may mention that the United Verde mines sharpened 500 steels in 7 hours and 140 in 75 minutes. At the Homestake mines 300 steels were sharpened in 5 hours. In both instances the men operating the sharpener were green hands with only two weeks' experience.

## Construction

The Ajax Sharpener includes a vertical hammer, consisting of a modified air drill, with anvil, dies and suitable support and guides which side-set and forge the wings, and a similar hammer set horizontally and provided with a second set of guides, dies and a clamp which does the dolly work and forges up the face of the bit.

The parts and general arrangement of the apparatus are shown in the illustration.

The following is a partial list of users

| | |
|---|---|
| Portland Gold Mining Co. | Victor, Colo. |
| United Verde Copper Co. | Jerome, Ariz. |
| Homestake Mining Co. | Lead, So. Dakota |
| Standard Mining Co. | Wallace, Idaho |
| Hecla Mining Co. | Wallace, Idaho |
| Bunker Hill and Sullivan M. & C. Co. | Wardner, Idaho |
| Frisco Consolidated Mining Co., Ltd. | Gem, Idaho |
| Tiger Poorman Mines | Burke, Idaho |
| Center Star Mining Co., Ltd. | Rossland, British Columbia |
| Baltic Mine, Houghton County | Baltic, Mich. |

## Complete Machine

A complete sharpener includes two special drills with fittings and parts, one set of dies and dollies and a full set of drawings showing how machine is to be set up.

| | |
|---|---|
| Price complete with drills F. O. B. works | $ |
| Price without drills F. O. B. works | |
| Extra set of dies and dollies (per set) | |

NOTE—If desired we will send an expert at customer's expense to set up the apparatus, although this is not necessary, as the drawings are clear and complete, and the machine very simple.

# Air Mains, Initial and Final Pressures

## 45 Pounds Initial Gauge Pressure

| Diameter of Pipe | Reduction of Final Pressure in 500 Feet | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 lb. | 2 lbs. | 3 lbs. | 5 lbs. | 7 lbs. | 9 lbs. | 12 lbs. |
| 1 Inch | 14 | 20 | 24 | 30 | 34 | 37 | 40 |
| 1¼ Inches | 26 | 36 | 44 | 54 | 62 | 68 | 74 |
| 1½ Inches | 43 | 60 | 72 | 90 | 102 | 112 | 121 |
| 2 Inches | 95 | 132 | 159 | 198 | 226 | 247 | 268 |
| 2½ Inches | 172 | 239 | 287 | 358 | 409 | 446 | 484 |
| 3 Inches | 281 | 390 | 470 | 585 | 667 | 728 | 791 |
| 3½ Inches | 419 | 583 | 701 | 874 | 997 | 1080 | 1180 |
| 4 Inches | 595 | 827 | 995 | 1240 | 1410 | 1540 | 1670 |
| 4½ Inches | 806 | 1120 | 1340 | 1680 | 1910 | 2090 | 2270 |
| 5 Inches | 1050 | 1470 | 1770 | 2200 | 2510 | 2740 | 2980 |
| 6 Inches | 1690 | 2350 | 2820 | 3520 | 4020 | 4380 | 4760 |
| 7 Inches | 2500 | 3480 | 4190 | 5220 | 5950 | 6500 | 7060 |
| 8 Inches | 3520 | 4900 | 5890 | 7340 | 8370 | 9140 | 9930 |
| 9 Inches | 4770 | 6630 | 7970 | 9930 | 11300 | 12300 | 13400 |
| 10 Inches | 6240 | 8680 | 10400 | 13000 | 14800 | 16100 | 17600 |

## 60 Pounds Initial Gauge Pressure

| Diameter of Pipe | Reduction of Final Pressure in 500 Feet | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 lb. | 2 lbs. | 3 lbs. | 5 lbs. | 7 lbs. | 9 lbs. | 12 lbs. |
| 1 Inch | 16 | 22 | 27 | 34 | 39 | 43 | 48 |
| 1¼ Inches | 29 | 41 | 49 | 62 | 72 | 79 | 87 |
| 1½ Inches | 48 | 67 | 81 | 102 | 117 | 129 | 143 |
| 2 Inches | 107 | 149 | 180 | 226 | 259 | 286 | 315 |
| 2½ Inches | 193 | 269 | 325 | 408 | 469 | 516 | 569 |
| 3 Inches | 315 | 440 | 532 | 667 | 766 | 844 | 930 |
| 3½ Inches | 471 | 657 | 794 | 996 | 1140 | 1260 | 1380 |
| 4 Inches | 668 | 932 | 1120 | 1410 | 1620 | 1780 | 1970 |
| 4½ Inches | 905 | 1260 | 1520 | 1910 | 2190 | 2420 | 2660 |
| 5 Inches | 1180 | 1650 | 2000 | 2510 | 2880 | 3170 | 3500 |
| 6 Inches | 1890 | 2650 | 3200 | 4010 | 4610 | 5080 | 5590 |
| 7 Inches | 2810 | 3920 | 4740 | 5950 | 6840 | 7530 | 8290 |
| 8 Inches | 3960 | 5520 | 6670 | 8370 | 9620 | 10500 | 11600 |
| 9 Inches | 5350 | 7470 | 9020 | 11300 | 13000 | 14300 | 15700 |
| 10 Inches | 7010 | 8710 | 11800 | 14800 | 17000 | 18700 | 20700 |

## 75 Pounds Initial Gauge Pressure

| Diameter of Pipe | Reduction of Final Pressure in 500 Feet | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 lb. | 2 lbs. | 3 lbs. | 5 lbs. | 7 lbs. | 9 lbs. | 12 lbs. |
| 1 Inch | 18 | 25 | 30 | 38 | 44 | 48 | 54 |
| 1¼ Inches | 32 | 45 | 55 | 69 | 80 | 89 | 98 |
| 1½ Inches | 53 | 74 | 90 | 113 | 131 | 145 | 161 |
| 2 Inches | 117 | 164 | 199 | 251 | 289 | 320 | 356 |
| 2½ Inches | 212 | 296 | 359 | 453 | 523 | 579 | 643 |
| 3 Inches | 346 | 484 | 587 | 740 | 855 | 946 | 1050 |
| 3½ Inches | 517 | 723 | 876 | 1100 | 1270 | 1410 | 1560 |
| 4 Inches | 734 | 1020 | 1240 | 1560 | 1810 | 2000 | 2220 |
| 4½ Inches | 994 | 1390 | 1680 | 2120 | 2450 | 2710 | 3010 |
| 5 Inches | 1300 | 1820 | 2210 | 2780 | 3220 | 3560 | 3950 |
| 6 Inches | 2080 | 2910 | 3530 | 4450 | 5140 | 5690 | 6320 |
| 7 Inches | 3090 | 4320 | 5230 | 6600 | 7630 | 8440 | 9370 |
| 8 Inches | 4350 | 6070 | 7360 | 9290 | 10700 | 11800 | 13100 |
| 9 Inches | 5880 | 8220 | 9960 | 12500 | 14500 | 16000 | 17800 |
| 10 Inches | 7710 | 10700 | 13000 | 16400 | 19000 | 21000 | 23300 |

## 90 Pounds Initial Gauge Pressure

| Diameter of Pipe | Reduction of Final Pressure in 500 Feet | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 lb. | 2 lbs. | 3 lbs. | 5 lbs. | 7 lbs. | 9 lbs. | 12 lbs. |
| 1 Inch | 19 | 27 | 33 | 41 | 48 | 53 | 60 |
| 1¼ Inches | 35 | 49 | 59 | 75 | 87 | 97 | 109 |
| 1½ Inches | 57 | 80 | 97 | 123 | 143 | 159 | 178 |
| 2 Inches | 127 | 178 | 215 | 273 | 316 | 351 | 394 |
| 2½ Inches | 229 | 321 | 390 | 493 | 572 | 635 | 712 |
| 3 Inches | 375 | 525 | 636 | 806 | 934 | 1030 | 1160 |
| 3½ Inches | 560 | 784 | 950 | 1200 | 1390 | 1550 | 1730 |
| 4 Inches | 794 | 1110 | 1340 | 1700 | 1980 | 2190 | 2460 |
| 4½ Inches | 1070 | 1500 | 1820 | 2310 | 2680 | 2970 | 3330 |
| 5 Inches | 1410 | 1970 | 2390 | 3030 | 3510 | 3900 | 4370 |
| 6 Inches | 2250 | 3160 | 3830 | 4850 | 5620 | 6240 | 6990 |
| 7 Inches | 3340 | 4680 | 5680 | 7190 | 8340 | 9260 | 10300 |
| 8 Inches | 4700 | 6590 | 7990 | 10100 | 11700 | 13000 | 14500 |
| 9 Inches | 6360 | 8930 | 10800 | 13600 | 15800 | 17600 | 19700 |
| 10 Inches | 8340 | 11600 | 14100 | 17900 | 20700 | 23000 | 25800 |

## 105 Pounds Initial Gauge Pressure

| Diameter of Pipe | Reduction of Final Pressure in 500 Feet | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 lb. | 2 lbs. | 3 lbs. | 5 lbs. | 7 lbs. | 9 lbs. | 12 lbs. |
| 1 Inch | 20 | 29 | 37 | 44 | 52 | 58 | 65 |
| 1¼ Inches | 37 | 52 | 68 | 81 | 94 | 105 | 118 |
| 1½ Inches | 61 | 86 | 111 | 133 | 155 | 172 | 194 |
| 2 Inches | 129 | 190 | 245 | 294 | 341 | 380 | 427 |
| 2½ Inches | 245 | 344 | 443 | 531 | 617 | 687 | 772 |
| 3 Inches | 401 | 562 | 724 | 867 | 1000 | 1120 | 1260 |
| 3½ Inches | 599 | 839 | 1080 | 1290 | 1500 | 1670 | 1880 |
| 4 Inches | 850 | 1190 | 1530 | 1830 | 2130 | 2370 | 2670 |
| 4½ Inches | 1150 | 1610 | 2070 | 2480 | 2890 | 3220 | 3610 |
| 5 Inches | 1510 | 2110 | 2720 | 3260 | 3790 | 4220 | 4750 |
| 6 Inches | 2410 | 3380 | 4350 | 5220 | 6070 | 6760 | 7590 |
| 7 Inches | 3580 | 5010 | 6460 | 7740 | 8990 | 10000 | 11200 |
| 8 Inches | 5030 | 7050 | 9080 | 10800 | 12600 | 14000 | 15800 |
| 9 Inches | 6810 | 9540 | 12200 | 14700 | 17100 | 19000 | 21400 |
| 10 Inches | 8920 | 12500 | 16100 | 19200 | 22400 | 24900 | 28000 |

## Example

It is required to deliver 2,000 cubic feet of equivalent free air at the end of a pipe line 1,500 feet long, the initial pressure being 60 pounds, and the loss of pressure not to exceed 10 pounds. What diameter of pipe must be used?

By table of 60 pounds initial pressure under 3 pounds loss, and opposite 5 inch diameter of pipe, we see that the delivery would be 2,000 cubic feet, so that for a pipe line 1,500 feet long, the loss of pressure would be about $3 \times \frac{1500}{500} = 9$ pounds. We say "about" 9 pounds, because the loss is not exactly proportional to the length, but nearly so, when the basis of length is 500 feet.

## Globe Valves, Tees and Elbows

The reduction of pressure produced by globe valves is the same as that caused by the following additional lengths of straight pipe, as calculated by the formula.

$$\text{Additional length of pipe} = \frac{114 \times \text{diameter of pipe}}{1 + (3.6 \div \text{diameter})}$$

| Diameter of pipe | 1 | 1½ | 2 | 2½ | 3 | 3½ | 4 | 5 | 6 | inches |
|---|---|---|---|---|---|---|---|---|---|---|
| Additional length | 2 | 4 | 7 | 10 | 13 | 16 | 20 | 28 | 36 | feet |
| | 7 | 8 | 10 | 12 | 15 | 18 | 20 | 22 | 24 | inches |
| | 44 | 53 | 70 | 88 | 115 | 143 | 162 | 181 | 200 | feet |

The reduction of pressure produced by elbows and tees is equal to two-thirds of that caused by globe valves. The following are the additional lengths of straight pipe to be taken into account for elbows and tees. For globe valves multiply by $\frac{2}{3}$.

| Diameter of pipe | 1 | 1½ | 2 | 2½ | 3 | 3½ | 4 | 5 | 6 | inches |
|---|---|---|---|---|---|---|---|---|---|---|
| Additional length | 2 | 3 | 5 | 7 | 9 | 11 | 13 | 19 | 24 | feet |
| | 7 | 8 | 10 | 12 | 15 | 18 | 20 | 22 | 24 | inches |
| | 30 | 35 | 47 | 59 | 77 | 96 | 108 | 120 | 134 | feet |

These additional lengths of pipe for globe valves, elbows and tees must be added in each case to the actual lengths of straight pipe. Thus, a 6-inch pipe, 500 feet long, with 1 globe valve, 2 elbows and 3 tees, would be equivalent to a straight pipe $500 + 36 + (2 \times 24) + (3 \times 24) = 656$ feet long.

The following table shows the efficiency and loss in capacity of compressors working at different altitudes, also the approximate decrease in power required as compared with the same compressor working at sea level and delivering air at 70 pounds pressure per square inch.

## Table of Efficiencies at Different Altitudes

| Altitude Feet | Barometric Pressure | | Volumetric Efficiency of Compressor Per Cent. | Loss of Capacity Per Cent. | Decreased Power Required Per Cent. |
|---|---|---|---|---|---|
| | Inches Mercury | Pounds per Square Inch | | | |
| 0 | 30.00 | 14.75 | 100. | 0. | 0. |
| 1,000 | 28.88 | 14.20 | 97. | 3. | 1.8 |
| 2,000 | 27.80 | 13.67 | 93. | 7. | 3.5 |
| 3,000 | 26.76 | 13.16 | 90. | 10. | 5.2 |
| 4,000 | 25.76 | 12.67 | 87. | 13. | 6.9 |
| 5,000 | 24.79 | 12.20 | 84. | 16. | 8.5 |
| 6,000 | 23.86 | 11.73 | 81. | 19. | 10.1 |
| 7,000 | 22.97 | 11.30 | 78. | 22. | 11.6 |
| 8,000 | 22.11 | 10.87 | 76. | 24. | 13.1 |
| 9,000 | 21.29 | 10.46 | 73. | 27. | 14.6 |
| 10,000 | 20.49 | 10.07 | 70. | 30. | 16.1 |
| 11,000 | 19.72 | 9.70 | 68. | 32. | 17.6 |
| 12,000 | 18.98 | 9.34 | 65. | 35. | 19.1 |
| 13,000 | 18.27 | 8.98 | 63. | 37. | 20.6 |
| 14,000 | 17.59 | 8.65 | 60. | 40. | 22.1 |
| 15,000 | 16.93 | 8.32 | 58. | 42. | 23.5 |

## Horse Power Developed to Compress 100 Cubic Feet Free Air, from Atmosphere to Various Pressures

| Gauge Pressure Pounds | One-stage Compression D. H. P. | Gauge Pressure Pounds | Two-stage Compression D. H. P. | Three-stage Compression D. H. P. | Four-stage Compression D. H. P. |
|---|---|---|---|---|---|
| 5 | 1.96 | 60 | 11.70 | 11.20 | 10.80 |
| 10 | 3.60 | 70 | 12.70 | 12.00 | 11.70 |
| 15 | 5.03 | 80 | 13.70 | 13.00 | 12.50 |
| 20 | 6.28 | 90 | 14.70 | 14.00 | 13.50 |
| 25 | 7.42 | 100 | 15.40 | 14.50 | 14.20 |
| 30 | 8.47 | 125 | 17.50 | 16.00 | 15.60 |
| 35 | 9.42 | 150 | 19.00 | 17.50 | 16.70 |
| 40 | 10.30 | 200 | 21.20 | 19.50 | 18.75 |
| 45 | 11.14 | 300 | 24.50 | 22.90 | 21.80 |
| 50 | 11.90 | 400 | 27.70 | 25.70 | 24.00 |
| 55 | 12.67 | 500 | 29.75 | 27.60 | 25.90 |
| 60 | 13.41 | 600 | 31.70 | 29.20 | 27.50 |
| 70 | 14.72 | 700 | 33.50 | 30.60 | 28.90 |
| 75 | 15.37 | 800 | 34.90 | 31.80 | 30.00 |
| 80 | 15.94 | 900 | 36.30 | 32.90 | 31.00 |
| 85 | 16.50 | 1,000 | 37.80 | 33.80 | 31.80 |
| 90 | 17.06 | 1,200 | 39.70 | 35.50 | 33.30 |
| 100 | 18.15 | 1,400 | 41.60 | 36.80 | 34.60 |
| 150 | 24.00 | 1,600 | 43.00 | 38.10 | 35.65 |
| 200 | 26.20 | 1,800 | 44.50 | 39.30 | 36.70 |
| 400 | 36.00 | 2,000 | 45.50 | 40.60 | 37.80 |
| .... | ..... | 2,500 | ..... | .... | 39.06 |
| .... | ..... | 3,000 | ..... | .... | 40.15 |

An addition of 10 to 15 per cent. should be made for friction and intake temperatures higher than 60 degrees F., on which this table is based. Atmospheric pressure is assumed at 14.7 pounds per square inch.

# Index to Telegraph Names

# General Index

# Publications of The Ingersoll-Sergeant Drill Co.

No. 35 CATALOGUE.—Air and Gas Compressors, Air Receivers, etc.

No. 43 CATALOGUE.—Rock Drills, Mining, Tunneling and Quarrying, Stone Channeling Machines, Gadders, Quarry Bars, etc.

No. 51 CATALOGUE.—Compressed Air in Coal Mines.

No. 73 CATALOGUE.—Lifting Water by Compressed Air.

No. 109 PAMPHLET.—Compressed Air in Railroad Shops.

No. 146 BOOKLET.—The Use of Compressed Air in the Monon Railroad Shops.

No. 147 BOOKLET.—Pumping Water by Compressed Air at Dixon, Ill.

No. 148 BOOKLET.—Model Compressed Air Foundry Plant.

No. 154 BOOKLET.—Rock Drill.

No. 166 BOOKLET.—Ingersoll-Sergeant Stone Channelers.

No. 167 BOOKLET.—Abundant Pure Water Underground.

No. 169 BOOKLET.—Index of Compressed Air and the Many Uses of Compresed Air.

No. 193 BOOKLET.—Baldwin Acetylene Lamp for Mines.

No. 194 BOOKLET.—Don't Circulars in Air.

No. 242 BOOKLET.—Moving 100,000 Tons of Rock.

No. 249 BOOKLET.—Baldwin Acetylene.

No. 254 BOOKLET.—Rock Drill Estimates.

No. 540 BOOKLET.—The City of Rockford.

In addition to the above we have Instruction Sheets, and a number of special pamphlets describing Ingersoll-Sergeant machinery, or applications of compressed air to the most important industries, any of which will be sent on request.

Chasmar-Winchell New York and Pittsburgh